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THE AUSTRALIAN ZOOLOGIST

Issued by
The Royal Zoological Society of New South Wales

WITH NINETEEN PLATES,
And Sixty-three Text-figures.

Vol. 1—1914-1920.



Sydney:
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11 Wilmot Street, Sydney.

SOLD BY THE SOCIETY.

CONTENTS OF PART I. (Price, 3/.)

	Page.
Report of the Council for 1913	1
The Mallophaga as a possible clue to Bird Phylogeny, by Launcelet Harrison, B.Sc.	7
Bird Sanctuaries, by A. F. Basset Hull	13
A Monograph of the genus <i>Tisiphone</i> , Hubner, by G. A. Waterhouse, B.Sc., B.E., F.E.S.	15
A New Victorian Araneid, by W. J. Rainbow, F.E.S.	21
Notes on the Breeding-habits of the Purple-striped Gudgeon, <i>Krefftius adspersus</i> , Castelnau, by Albert Gale	25
A new Australian Caprellid, by Rev. Thomas R. R. Stebbing, M.A., F.R.S., F.L.S., F. Z. S.	27
Notes on some Australian Syngnathidae, by A. R. McCulloch	29
Bird Notes from the North-west of New South Wales, by Walter W. Froggatt, F.L.S.	33
An Interesting Exhibit, by A. S. Le Souef, Director, Zoological Gardens . .	35

CONTENTS OF PART II. (Price, 2/.)

Report of the Council for 1914	37
List of Members, 1914	41
Bird Notes, by Walter W. Froggatt, F.L.S.	44
Two Beetles apparently new to Australia, by W. J. Rainbow, F.E.S. . . .	46
The Migration of the Jolly-tail or Eel Gudgeon, <i>Galaxias attenuatus</i> , from the sea to fresh-water, by A. R. McCulloch	47
Further notes on the genus <i>Tisiphone</i> , Hubner, by G. A. Waterhouse, B.Sc., B.E., F.E.S.	50

CONTENTS OF PART III. (Price, 2/.)

Report of the Council for 1915	53
Some new Araneidae from the County of Cumberland, by W. J. Rainbow, F.E.S.	58
Notes on Colour-variation of Opossums of the genus <i>Trichosurus</i> , by A. S. Le Souef, Director, Zoological Gardens	62

CONTENTS OF PART IV. (Price, 3/.)

Report of Council for 1916	Front Pages.
The Royal Zoological Society of New South Wales. Its present position and future aims, by A. F. Basset Hull, President	65
The Economics of <i>Troglodytes niloticus</i> , by Charles Hedley	69
The Destruction of Bird Life in Australia, by Walter W. Froggatt, F.L.S. .	75
The Lyre Bird: Some Nesting Notes, by John Ramsay and Albert E. Keene .	81
Kangaroos in Captivity, by H. L. White	83
illustrations of Australian Coleoptera, by A. Musgrave and E. H. Zeck . .	85
The deposition of the eggs of Monotremes, by Harry Burrell	87
Ichthyological notes, by Allan R. McCulloch	89
The Great Black Palm Cockatoo, <i>Microglossus aterrimus</i> , in captivity, by Dr. E. A. D'Ombain, M.R.A.O.U.	95

iii.

CONTENTS OF PART V. (Price, 4/.)

	Page.
Taronga Zoological Park	99
Royal Zoological Society of New South Wales	100
The Distribution of <i>Anaspides</i> and <i>Ooperipatus</i> in Tasmania, by Professor T. Thomson Flynn	102
Birds in my Garden, by Henry L. White	103
The Birds of the Cobbora District, by Thomas P. Austin	109

CONTENTS OF PART VI. (Price, 4/.)

Royal Zoological Society of New South Wales:	
Report of Annual Meeting	139
Balance Sheet	142
List of Members	143
Notes on some of the smaller Marsupials of the Genera <i>Phascogale</i> , <i>Sminth-</i> <i>opsis</i> , <i>Aerobates</i> and <i>Dromicia</i> , by A. S. Le Souef, Director, Zoological Gardens, and Harry Burrell	147
Notes on records of Tree Kangaroos in Queensland, by T. Harvey Johnston, M.A., D.Sc., and C. D. Gillies, M.Sc., University of Queensland, Brisbane	153
Rescue Operations on the Murrumbidgee River, by H. K. Anderson, Inland Fisheries Officer	167
Notes on the Kelp Shell <i>Cantharidus irisodontes</i> , by Ernest Mawle	161
Notes on the Life History of an Emerald Moth, <i>Eucyclodes metaspila</i> , Walker, by E. H. Zeek	163
Studies in Phlebotomic Diptera, No. 1. New Species of Simuliidae and Chironomidae, by Frank H. Taylor, F.E.S.	167
A Parasite, <i>Myxobolus hylae</i> , sp. nov., of the reproductive organs of the Golden Swamp Frog, <i>Hyla aurea</i> , by T. Harvey Johnston, M.A., D.Sc., and M. J. Bancroft, B.Sc.	171
Ornithological Notes, edited by A. F. Basset Hull	177
The Flight of a Falcon, by Thomas P. Austin	185
The Birds and Animals Protection Act, 1918	188
The Crow Family, by Walter W. Froggatt, F.L.S.	189

CONTENTS OF PART VII. (Price, 4/6.)

Royal Zoological Society of New South Wales:	
Report of Annual Meeting	197
Balance Sheet	200
List of New Members	201
About Hands, by Charles Hedley	203
The Australian Museum—Notice only	204
Swarming of the Soldier Beetle, <i>Telephorus pulchellus</i> , by E. H. Zeek	205
Notes on the Plumage-display of the Birds of Paradise in Taronga Park, by A. S. Le Souef	206
A simple method of preparing Crania, by Heber A. Longman	208
Aviary Notes on the Pectoral Rail, <i>Hypotaenidia philippensis</i> , L., by T. C. Marshall	210
The Spine-tailed Swift, <i>Chaetura caudacuta</i> , by H. E. Finekh	211
Life History of the Fish, <i>Galaxias attenuatus</i> , by W. J. Phillipps	211
Note on the Mouth-parts of Lice, by Launcelet Harrison, B.Sc., B.A.	214
Check list of the Fish and Fish-like Animals of New South Wales, Part I., by Allan R. McCulloch	217

iv.

CONTENTS OF PART VIII. (Price, 4/.)

	Page.
Royal Zoological Society of New South Wales	229
Field Notes on the Life History of Monotremes—I., by Harry Burrell .. .	231
Notes on the Habits and Reproduction of the Great Western Burrowing Frog, by Prof. W. J. Dakin, D.Sc., F.L.S., F.Z.S.	241
Myrmecophilous Coleoptera, by E. H. Zeck	245
On a New Species of <i>Lophopodella</i> , by Rex W. Bretnall	248
Notes on the Breeding of the Scrub Turkey, by A. S. Le Sonef	251
The Wedge-tailed Eagle, by Walter W. Froggatt, F.L.S.	252
Nature Notes	255
Title-page, Vol. 1.	i.
Contents of Vol. 1	ii.
Index	i.

- About hands, 203.
Acrobates, notes on, 147.
Anaspides, distribution in Tasmania, 102.
 Anderson, H. K., Rescue operations on the Murrumbidgee River, 157.
 Araneidae, some new, 58.
 Araneid, a new Victorian, 21.
 Austin, T. P., Birds of Cobbora District, 109.
 ———, The flight of a falcon, 185.
 Australian Caprellid, A new, 27.
 ——— Coleoptera, Illustrations of, 85.
 ——— Pipe-fishes, 29.
 Avian notes, Pectoral rail, 208.
 Bancroft, M. J., see Johnston & Bancroft.
 Beetles, new to Australia, 46.
 Bird notes, 33, 44.
 — life, destruction of, 75.
 — sanctuaries, 13.
 Birds and Animals Protection Act, 1918, 188.
 — in my garden, 103.
 — of the Cobbora District, The, 109.
 — of paradise, plumage display, 206.
 Breeding habits, *Krefftius adspersus*, 25.
 Brettnall, R. W., New species of *Lophopodella*, 248.
 Burrell, H., Deposition of eggs of Monotremes, 87.
 ———, Life history of Monotremes, 231.
 ———, see Le Souef and Burrell.
Cantharidus irisodontes, Notes on, 161.
 Caprellid, New Australian, 27.
Carepalxis poweri n.sp. (Araneidae), 61.
Chaetura caudacuta, 210.
 Check-list of the Fish of N.S. Wales, 217.
 Chironomidae, New species of, 167.
 Cobbora District, Birds of, 109.
 Cockatoo, Great Palm, in Captivity, 95.
 Coleoptera, Australian, Illustrations of, 85.
 ———, Myrmecophilous, 245.
 Colour variations of *Trichosurus*, 62.
 Crow family, The, 189.
Culicoides townsvillensis n.sp. (Diptera), 169.
 ——— *multimaculatus n.sp.* (Diptera), 169.
 Dakin, W. J., Great Western Burrowing Frog, 241.
 Deposition of eggs of Monotremes, The, 87.
 Destruction of bird life in Australia, The, 75.
 Distribution of *Anaspides* and *Ooperipatus* in Tasmania, The, 102.
 D'Ombraïn, E. A., Great Palm Cockatoo, 95.
Dromicia, Notes on, 147.
 Economics of *Trochus niloticus*, The, 69.
 Eel-gudgeon, migration of, 47.
 Eggs of Monotremes, deposition of, 87.
 Emerald Moth, Life History of, 163.
Eucyclodes metaspile, Life history, 163.
 Falcon, flight of, 185.
 Field Notes on the life history of Monotremes, 231.
 Finckh, H. E., The Spine-tailed Swift, 210.
 Fish of N.S. Wales, Check-list of, 217.
 Flight of a falcon, The, 185.
 Flynn, T. T., *Anaspides* and *Ooperipatus* in Tasmania, 102.
 Frog, Great Western Burrowing, 241.
 Froggatt, W. W., Birds of N.W. N.S. Wales, 33.
 ———, Bird notes, 44.
 ———, Destruction of bird, life, 75.
 ———, Crow family, 189.
 ———, Wedge-tailed Eagle, 252.
Galaxias attenuatus, migration of, 47.
 ———, life history of, 211.
 Gale, A., Purple-striped gudgeon, 25.
 Genus *Tisiphone*, Monograph of, 15.
 ———, Further notes on, 50.
 Gillies, C. D., see Johnston and Gillies.
 Great Black Palm Cockatoo in captivity, The, 95.
 Harrison, L., Mallophaga and bird Phylogeny, 7.
 ———, Mouth-parts of lice, 214.
 Hedley, C., Economics of *Trochus*, 69.
 ———, About hands, 203.
Heleioporus albopunctatus, 241.
Histiogamphelus, gen. nov., (Pisces), 30.
 ———, *briggsii*, n.sp., 30.
 Hull, A. F. B., Bird sanctuaries, 13.
 ———, Royal Zoological Society, 65.
Hyla aurea, Parasite of, 171.
Hypotaenidia philippensis, aviary notes, 208.
 Ichthyological Notes, 89.
 Illustrations of Australian Coleoptera, 85.
 Interesting exhibit, An, 35.

- Johnston, T. H., and Gillies, C. D., Records of Tree Kangaroos, 153.
 —————, and Baneroff, M. J., *Myxobolus hylae*, 171.
 Jolly-tail, migration of, 47.
 Kangaroos in captivity, 83.
 —————, Tree, 153.
 Keene, A. E., see Ramsay and Keene.
 Kelp shell, Notes on, 161.
Krefftius adpersus, breeding habits, 25.
 Le Souef, A. S., An interesting exhibit, 35.
 —————, Colour variations in *Trichosurus*, 62.
 —————, Plumage of birds of paradise, 206.
 —————, Breeding of Scrub Turkey, 251.
 —————, and Burrell, H., Notes on the smaller marsupials, 147.
 Lice, mouth-parts of, 214.
 Life history of Emerald Moth, 163.
 ————— of *Galaxias attenuatus*, 211.
 Longman, H. A., Simple method of preparing crania, 208.
Lophopodella picta n.sp. (Polyzoa), 248.
 Lyre-bird, some nesting notes, 81.
 McCulloch, A. R., Australian Pipe-fishes, 29.
 —————, Migration of *Galaxias*, 47.
 —————, Ichthyological notes, 89.
 —————, Check-list of Fish of N.S. Wales, 217.
 Mallophaga, clue to bird phylogeny, 7.
 Marshall, T. C., Aviary Notes, Pectoral Rail, 208.
 Marsupials, smaller, notes on, 147.
 Mawle, E., Notes on the Kelp shell, 161.
Microglossus aterrimus in captivity, 95.
 Migration of *Galaxias*, 47.
 Monograph of genus *Tisiphone*, 15.
 Monofremes, Deposition of eggs of, 87.
 —————, Field notes on, 231.
 Mouth-parts of lice, Note on, 214.
 Murrumbidgee River, Rescue operations on, 157.
 Musgrave, A., and Zuck, E. H., Illustrations of Coleoptera, 85.
 Myrmecophilous Coleoptera, 245.
Myxobolus hylae n.sp. (Protozoa), 171.
 Nature notes, 255.
Neostorena, new genus of Araneidae, 21
 ————— *venatoria*, n.sp., 22.
 Nesting notes, Lyre-bird, 81.
 New Araneidae, 58.
 ————— Australian Caprellid, 27.
 ————— South Wales, Check-list of Fish of, 217.
 ————— species of Simuliidae and Chironomidae, 167.
 ————— species of *Lophopodella*, 248.
 ————— Victorian Araneid, A, 21.
 Notes, Purple-striped Gudgeon, 25.
 —————, Australian Pipe-fishes, 29.
 —————, Colour variation of opossums, 62.
 —————, Lyre-bird nesting, 81.
 —————, Ichthyological, 89.
 —————, on smaller marsupials, 147.
 —————, on records of tree kangaroos in Queensland, 153.
 —————, Kelp shell, 161.
 —————, life history of Emerald Moth, 163.
 —————, Ornithological, 177.
 —————, plumage display of birds of paradise, 206.
 —————, mouth-parts of lice, 214.
 —————, Great Western Burrowing Frog, 241.
 —————, Breeding of Scrub Turkey, 251.
 —————, Nature, 255.
Ooperipatus, distribution in Tasmania, 102.
 Opossums, colour variations of, 62.
 Ornithological Notes, 177.
Paraproto gabrieli n.sp. (Caprellidae), 27.
 Pectoral Rail, Aviary notes, 208.
Phascogale, notes on, 147.
 Phillipps, W. J., Life history of *Galaxias*, 211.
Phylarchus splendens n.sp. (Araneidae), 60.
 Pipe-fishes, Notes on Australian, 29.
 Purple-striped Gudgeon, breeding habits, 25.
 Queensland, Tree kangaroos in, 153.
 Rainbow, W. J., New Araneid, 21.
 —————, Two beetles new to Australia, 46.
 —————, Some new Araneidae, 58.
 —————, death of, 230.
 Ramsay, J., and Keene, A. E., Nesting notes on the Lyre-bird, 81.
 Records of tree Kangaroos, 153.
 Rescue operations on the Murrumbidgee, 157.
 Royal Zoological Society, Report, 1913, 1.
 —————, —————, 1914, 37.
 —————, —————, 1915, 53.

- , ———, 1916, 65.
 —————, ———, 1917, 139.
 —————, ———, 1918, 197.
 —————, List of Members, 1914, 41.
 —————, List of Members, 1918, 143.
 —————, New Members, 100, 201, 229.
 —————, New Rules, 100.
 —————, Present position and future aims, 65.
- Scrub Turkey, Breeding of, 251.
 Simple method of preparing crania, A, 208.
 Simuliidae, New species of, 167.
Simulium bancrofti n.sp. (Diptera), 168.
Sminthopsis, Notes on, 147.
 Soldier beetle, swarming of, 205.
 Some new Araneidae, 58.
 Spine-tailed Swift, The, 210.
 Stebbing, T. R. R., New Caprellid, 27.
 Studies in Phlebotomic Diptera, 167.
 Swarming of the Soldier beetle, 205.
- Taronga Zoological Park, 99.
 Tasmania, Distribution of *Anaspides* and *Ooperipatus* in, 102.
- Taylor, F. H., New species of Simuliidae and Chironomidae, 167.
Telephorus pulchellus, swarming of, 205.
Tisiphone, Monograph of the genus, 15.
 ———, Further notes on, 50.
 ——— *abeona marrisii*, sub. sp. nov., 18.
 ——— *aurelia*, sub. sp. nov., 50.
 Tree Kangaroos in Queensland, 153.
Trichosurus, colour variations, 62.
Trichosurus caninus nigrans sub. sp. nov., 64.
Trochus niloticus, Economics of, 69.
Uloborus congregabilis n.sp. (Araneidae), 59.
- Waterhouse, G. A., Monograph of genus *Tisiphone*, 15.
 ———, Further notes on *Tisiphone*, 50.
- Wedge-tailed Eagle, The, 252.
 White, H. L., Kangaroos in captivity, 83.
 ———, Birds in my garden, 103.
- Zeck, E. H., Life history of an Emerald Moth, 163.
 ———, Swarming of the Soldier beetle, 205.
 ———, Myrmecophilous Coleoptera, 245.
 ———, see also Musgrave and Zeck.

2974

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The Royal Zoological Society of New South Wales

Edited by
ALLAN R. MCCULLOCH,
Zoologist, Australian Museum

Vol. I.—Part 1.

Sydney, 13th June, 1914

SYDNEY:
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Royal Zoological Society of New South Wales

ESTABLISHED 1879

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Albert E. Nash. R. H. Todd M.D., F.R.C.S.I.

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Sydney Dodd, D.V.Sc., Dr. V.Sc.

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H. E. Finckh.

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Auditors:

Messrs. L. S. Drummond and Co.

Superintendent:

R. K. Spencer.

The Report of the Council

OF THE

Royal Zoological Society of New South Wales

For the Year ended December 31st, 1913.

ANNUAL MEETING.

The Annual General Meeting of the Society was held on February 19th, at which the six retiring Members of the Council were re-elected, viz.:—Mr. Finckh, Mr. Hedley, Mr. Hull, Mr. Jaques, Mr. Rainbow, and Colonel Spain. The Hon. Fred. Flowers, M.L.C., and Mr. H. C. Hoyle, M.L.A., were appointed to represent the Government, and Aldermen J. H. Laurence and W. J. Walker to represent the City Council.

At a Meeting of the Council held subsequently, the following Office-Bearers were elected:—President, Colonel A. Spain; Vice Presidents, Mr. Hedley, Mr. Hull, Mr. Nash, Dr. Todd; Treasurer, Mr. Green.

OBITUARY.

It is with great regret that the Council record the death of one of their Members in the person of the late Dr. H. V. Critchley Hinder, who took a deep interest in the welfare of the Gardens. The following Minute has been placed on the records of the Society:—

"That this Council desires to record its high appreciation of the valuable services rendered to the Royal Zoological Society of New South Wales, by the late Dr. Critchley Hinder, the news of whose sad and untimely death has been received with the greatest regret and sorrow."

Major J. Spencer Brunton, a former Member of the Council, was elected to the vacancy.

Attendance of Members of the Council at Meetings:—Dr. Sydney Dodd, 11; Mr. H. E. Finckh, 11; Mr. W. W. Froggatt, 7 (leave for 3 months); Mr. W. J. Green, 12; Mr. Charles Hedley, 11; Mr. L. Harrison, 8; Mr. A. F. Basset Hull, 11; Mr. A. E. Jaques, 6; Dr. Sydney Jamieson, 7; Mr. T. W. Keele, 9; Mr. Allan McCulloch, 11; Mr. Albert E. Nash, 6 (leave for 3 months); Mr. W. J. Rainbow, 10; Colonel A. Spain, 12; Mr. S. T. D. Symons, 4 (leave for 6 months); Mr. J. M. Smail, 5; and Dr. R. H. Todd, 5 (leave for 6 months).

Dr. R. H. Todd, during a visit to Europe, took the opportunity of visiting many Zoological Institutions, and has furnished much useful information concerning them.

ATTENDANCES.

During the year 295,688 people passed through the Turnstiles; details are as follows:—

Sundays, Adults	102,590
" Children	42,946
Week Days, Adults	105,991
" " Children	42,260
Schools	1,331
Officers and Men of Australian Navy . .	176
" " " Japanese Navy . . .	379
" Fiji Islanders	15
	<hr/>
	295,688

There has been a considerable reduction in the number of visitors from the country to the Gardens as compared with last year. This was partly owing to the exceedingly wet winter months, and partly to the smallpox visitation, with the practical isolation of Sydney for many months.

In March, the Sunday admission charge for Adults was raised from 2d. to 3d.

PREMISES.

As in the previous year very little building has been done owing to the projected removal to the New Site. An enclosure was constructed to accommodate four Pandas, and a small case for Chameleons was placed outside the Aquarium. The verandah was taken off the Lion enclosures so as to allow the inmates as much of the sun as possible, while the Kangaroo paddocks were backed with brushwood, thus adding to the comfort of the Animals. The large Ponds developed cracks, which had to be cut out and repaired. The glass Snake case in the centre of the Aquarium was removed to the outside of the building, so as to obtain sufficient ventilation for the Reptiles.

Owing to the excessive rain during the Winter, the water level in the centre of the Grounds was raised several feet, and the ponds were covered for some months. Some Pepper trees were killed, but this was the only damage which resulted.

ANIMALS

The most interesting additions to the collection during the year were four Pandas, which were placed in a new set of cages near the Lion house. These Animals are handsomely coloured and of a lively disposition, and are favourites with the Public; the Chameleons also proved an attractive exhibit; their variations of colour and method of feeding being of special interest.

The Reticulated Python and several large Carpet Snakes are doing well in the outdoor Reptile enclosure, and an interesting collection of our larger Lizards is shown in the old glass Snake case.

A good collection of fresh-water Fishes and other water fauna is being maintained in the Aquarium. The Murray Cod has hitherto proved rather difficult to keep, but our specimen has become established and is doing well, being shielded from the light by a cairn of stones. The fresh-water Sunfishes, which are some of the prettiest and most lively of Australian fresh-water fishes, have proved quite hardy, and have lived through the Winter without special heating.

The large flight Aviaries are well stocked with Australian Birds; the Woodswallows, Blue Wrens, Lunulated Honeyeaters, Smith's Partridge Pigeons, and the Blood-breasted Pigeons have hatched and reared young during the year.

A pair of Crab Spiders have been placed on exhibition in the Aquarium. They apparently do well in captivity, as the female has woven a nest and is brooding her eggs.

Mention might be made that the Elephant "Jessie" has now been in the Gardens for thirty years; she arrived in the year 1883 a little more than half grown.

Several interesting Kangaroos were procured from North-west Australia, including the brightly coloured *Macropus occidentalis* (which is the western form of Red Kangaroo), the rich brown *Cervinus Wallaroo*, *M. robustus cervinus*, and the small Woodward's Wallaroo, *M. robustus woodwardi*; the two former have not previously been exhibited in the collection.

317 Specimens were presented to the Society during the year, and the Council wish to express their thanks to the Donors, who thus enriched the collection; especially to Mr. Forth for a very interesting Red Wallaroo from Broome, Western Australia.

The following Births took place during the period under review:—

1 Mongoose Lemur	1 Northern Rock Wallaby
1 Highland Calf	1 Antilopine Kangaroo
1 Axis Deer	1 Rat Kangaroo
1 Timor Deer	7 Blood-breasted Pigeons
1 Rusa Deer	2 Squatter Pigeons
1 Fallow Deer	3 White-browed Woodswallows
1 Arabian Gazelle	2 Black-capped Honeyeaters
1 Indian Antelope	2 Superb Warblers
2 Angora Goats	4 Canaries
3 Goats	3 Water Dragons
1 Bennett's Wallaby	60 Chameleons

731 Specimens were added by purchase, and 34 received in exchange, while 312 were sold, and 131 sent in exchange. The value of the collection at the end of the year was estimated at £4652.

Established Aquariums were sent to the Sydney Hospital, and to the Public School at Robertson.

60 Young Chameleons, born in the Gardens, were liberated in the Botanical Gardens, where, should they become established, they will be very useful in keeping the Plants free from Aphids and other Insects.

At the request of Messrs. Lever Bros., Ltd., several Magpies, Jackasses, Dragon and Bearded Lizards were forwarded to the Solomon Islands in the hope that they would prove useful in checking the Sugar Cane and Coccoanut Beetles, while some Magpies were sent to the Customs Authorities in Samoa for a similar purpose.

GENERAL.

The Council has decided to issue a serial publication entitled, "The Australian Zoologist," to contain articles of Scientific and general interest, pertaining to Zoology.

THE NEW SITE.

Members of the Society will be interested in information regarding the progress of the work at Taronga Park, the grounds of which are being prepared to serve as the new Zoological Gardens. The Council of the Society is intimately connected with the Trust in charge of Taronga Park, and the services of the Director have been placed largely at its disposal.

About Six Thousand Pounds (£6000) has been expended on the Grounds during the past year; the Park has been enclosed with a temporary fence and half of the area has been cleared and planted with about 2000 trees, shrubs, palms and ferns. The principal roads have been formed and a series of ponds completed and stocked. The remainder of the Grounds is being cleared, and good progress is being made with the construction of enclosures for Monkeys and Aviaries.

Sydney.

February 2nd, 1914.

The Council,

The Royal Zoological Society of New South Wales,

Moore Park,

SYDNEY.

Dear Sirs,

We have to report the completion of writing up and auditing the Books and Vouchers of the Society for the year ended 31st December, 1913, and have certified to the accompanying Statement of Receipts and Disbursements, as being in accordance therewith.

With a few exceptions, the vouchers have all been seen, and the production of those missing is promised us in due course.

RECEIPTS.

The Receipts of the year, as set out in detail on the attached Statement, totalled	£6036 14 6
The Receipts for the year 1912 were	8963 12 5
Being a decrease of	<u>£2926 17 11</u>

It will be seen from the following comparative Statement, that the decrease in Revenue for the year under review, as compared with 1912, is practically accounted for by the fact that in 1912 a Government Grant of £3000 was received, whereas in 1913 no subsidy was received.

With regard to the decrease in expenditure, this is also largely due to an amount of £1000 being transferred in 1912 to the New Zoo Trust, and not in 1913.

The following comparison of Receipts and Expenditure with those for the year ended 31st December, 1912, will explain in detail the decrease of Receipts and Expenditure.

Yours faithfully,

(Signed) L. S. DRUMMOND & CO.

The Royal Zoological Society of New South Wales.

STATEMENT OF RECEIPTS AND DISBURSEMENTS FOR THE YEAR ENDED 31st
DECEMBER, 1913.

RECEIPTS.	DISBURSEMENTS.
Jan. 1, 1913.—	Dec. 31, 1913.—
To BANK BALANCES.	By Salaries and Wages £3160 8 11
Government Savings	Improvements to
Bank £529 3 2	Premises 279 13 2
General Account 166 5 0	Maintenance of Pre-
Director's Trust Ac-	mises 351 4 1
count 10 0 0	Purchase and Trans-
£705 17 2	port of Animals
Cash in hand 50 15 9	Maintenance of An-
Petty Cash in hand 4 11 0	imals 1577 11 8
55 6 9	Advertising 389 16 11
Dec. 31.—	Office and Printing
Gate Receipts 4579 17 2	Expenses 134 1 1
Elephant Rides 323 6 8	Incidentals 171 9 2
Subscriptions 58 16 0	Guides, Cost of pub-
Sale of Animals 406 16 6	lishing 58 14 0
Sale of Hides, Skins,	Bank Interest 1 15 4
etc. 160 17 6	Transport of Ani-
Rents 170 0 0	mals sold 62 13 4
Fines 34 2 9	£6822 17 5
Interest on Deposit	BANK BALANCE.
with Govt. Sav-	Director's Trust Ac-
ings Bank 6 1 6	count 19 19 1
Refund by Treas-	Add Amount to be
urer of New	refunded by
Zoo Trust 250 0 0	New Zoo 1 3 5
Sundries 6 1 7	21 2 6
Advertising in	Cash in hand 105 6 1
Guides 35 6 0	Petty Cash in hand 16 11 10
Sales of Guide 5 8 10	121 17 11
6036 14 6	
BANK OVERDRAFT.	
General Account 167 19 5	
£6965 17 10	£6965 17 10

We have examined the Books and Vouchers of the Society for the year ended 31st December, 1913, and certify the above Statement to be in accordance therewith.

Sydney, 2nd February, 1914.

(Signed) L. S. DRUMMOND & CO.
Incorporated Accountants.

THE MALLOPHAGA AS A POSSIBLE CLUE TO BIRD PHYLOGENY.

By LAUNCELOT HARRISON, B. Sc.

In taking up a study of the Mallophaga, or Biting Lice, which are chiefly, though not entirely, parasitic on birds, after a number of years of study of the hosts themselves, my attention was very early directed towards a very remarkable correspondence between the species-groups of these parasitic insects coming from definite host-groups. Thus I found that a species of *Philopterus* from the common Australian cuckoo *Cacomantis flabelliformis* was hardly specifically distinct from the parasite of the European cuckoo *Cuculus canorus*. Yet these two birds have widely diverged from one another in their progress from the common ancestral stock. In addition, these parasites, with others from other species of cuckoos distributed throughout the world, form a definite group within the genus *Philopterus*, which is easily recognisable on its structural characters; so that one may say at a glance that any one of the species has come from a cuckoo. Similarly, species of *Philopterus* obtained from Kingfishers of different genera, and of world-wide distribution, have definite features in common which enable them to be recognised both as showing close relation one to another, and as having come from Kingfisher hosts.

So far, I have only instanced two picarian families, but when the distribution of parasites among the orders of birds is studied, it is found that the same relation holds. Mallophagan parasites of hawks, ducks, pigeons, or shore-birds, all afford well-defined groups, the distribution of which is confined to, in most cases, a single host order. So much is this the case, that Piaget (1880), in his great monograph, has divided up the unwieldy Mallophagan genera into a number of sections; in the first place quite frankly upon host distribution, but he has nevertheless been able to give diagnoses for these groups based upon their structural peculiarities.

In seeking for an explanation of this condition of distribution, I was forced to the conclusion that the parasites, owing to the equable conditions of temperature and nutrition under which they lived, had not tended to differentiate at the same rate as their hosts. The Mallophaga do not voluntarily leave the body of their host, and cannot live away from it for more than a few hours. Their whole life is thus passed upon the body of the bird (or mammal), the temperature of which is constant. Similarly they feed upon barbules of feathers, epidermal scales, &c., which have a fairly constant chemical composition. And they undergo no particular struggle for existence, as they are rarely found upon any one host individual in such numbers as to render the obtaining of sufficient food a matter of difficulty. The stimulus to a rapid differentiation is therefore absent, and the usual fluctuating variations exist comfortably side by side, none tending to become dominant at the expense of the others. There are some other interesting points in the biology of the Mallophaga, which are admirably summarised by Kellogg (1913, pp. 130 sqq.).

The same author has also (1896, p. 51) come to the conclusion put forth at the beginning of the last paragraph. He writes:—"The occurrence of a parasitic species common to European and American birds, which is not an infrequent matter, must have another explanation than any yet suggested. This explanation, I believe, is, for many of the instances, that the parasitic species has persisted unchanged from the common ancestor of the two or more now distinct but closely allied bird-species." And again, less cautiously (1913, p. 157):—"Now, removing all cases of even an imaginable rare possible contact of bodies between these related but specifically distinct hosts, such as might occur in birds of circum-arctic range, or in gregarious maritime kinds, meeting on common mid-ocean islands, or in kinds occasionally exported by man from their normal range, etc., there are still left many cases of this commonness of a parasite species to two or more usually rather closely related host species of quite distinct geographic range. How can this actual condition be explained?"

"I can see but one answer. That is, that the parasite species has been handed down practically unchanged to the present specifically and even generically distinct several bird species from their common ancestor of earlier days. The parasite species dates from the days of this ancestor."

It will be noted that Kellogg refers only to the same parasitic species being found on allied bird forms in Europe and America, but the argument holds also for allied forms of parasites. Having come to the conclusion that we had, in the Mallophaga, to deal with a case of retarded evolution, the next question that naturally arose was—How far back does this retardation extend? In other words, would it be possible by a careful study of the Mallophaga, and of their host distribution, to gain any clue as to the inter-relationship of the hosts themselves. As the result of a little preliminary inquiry, I became convinced that there was some hope of such a result, and in September, 1911, read before the Sydney University Science Society, a short paper discussing this possibility, a summary of which was printed in the Annual Report of the Society for that year.

The propriety of attempting to indicate phyletic relationships by such means as a study of the distribution of parasites may be questioned. But in the case of birds, in attempts to satisfactorily classify which all the resources of morphology and embryology have been employed in vain, I would submit that nothing that is likely to throw a gleam of light should be lightly set aside. Birds are easily divided into a number of admittedly natural groups, but hardly any two systematists can be found in agreement as to the relationship of these groups among themselves. Professor Newton was so dissatisfied with all attempts at classification that he published his wealth of ornithological learning in the form of a "Dictionary of Birds," just to avoid a systematic arrangement. Embryology, which has helped to clear up so many phyletic difficulties, has only produced a series of results monotonous in their uniformity. Morphology, too, has merely confirmed the general sameness of bird structure, the efforts of Garrod, Forbes and others to establish a classification on the variation of this organ, or the presence or absence of that, all ending in failure. One has only to compare any of the recent attempts at classification of birds, to see how hopelessly at variance are their authors. Beyond a general agreement that the passerine birds constitute the highest and most specialised order, nothing is certain.

In view of the fact that all the ordinary biological means have failed, I think it quite justifiable that an attempt should be made to see what light may be thrown upon bird phylogeny by a study of bird parasites.

An examination of the literature to see whether the above idea had occurred to any other worker disclosed only one suggestive sentence, prior to a paper by Kellogg in 1913. Giebel and Taschenberg, two monographers of the *Mallophaga*, give no sign of having recognised any remarkable condition of affairs in the relation of parasite to host. Piaget, although he clearly exposed this condition, did so more or less accidentally, and has not indulged in any speculations on it. Kellogg, on the other hand, wrote (Kellogg & Kuwana, 1902, p. 458) :—

"It was hoped that the character of the parasites found on the strictly Galapagos Island bird hosts might throw some light on the relationships of these birds to continental genera and species,"

This hope was defeated by the extraordinary conditions obtaining on the islands, birds of different orders huddling together promiscuously on the bare rocks, and their parasites becoming hopelessly mixed. The germ, however, was with Kellogg in 1902, and in 1913 (p. 138) he writes much more definitely :—

"Of the other Mallophagan genera found on the tinamous two that specially characterize the pheasants and other gallinaceous birds are, by odds, the most commonly represented. And this condition suggests another interesting problem. Is it going to be possible to get suggestions regarding the phyletic affinities of hosts from the character of their parasitic fauna? Take, for example, an order of birds troublesome to the ornithological taxonomists. Will the evidence of the presence on members of this order of certain parasitic genera characteristic of another order, indicate their affinities to this second order? It does indeed seem, in the case of the Tinamiformes and Galliformes, as if the evidence from the Mallophagan distribution was in conformity with that suggested by certain structural similarities in the two groups."

Seeing that Professor Kellogg has now put into words the concrete question which I had already been disposed to answer in the affirmative myself, nothing can be gained by any further diffidence on account of the unconventional nature of the suggestions put forward. I am of the opinion, after a careful preliminary study of the relationships between the Mallophaga and their hosts, that when a more complete study of these parasites has been made they will afford very considerable help towards solving the vexed question of bird phylogeny.

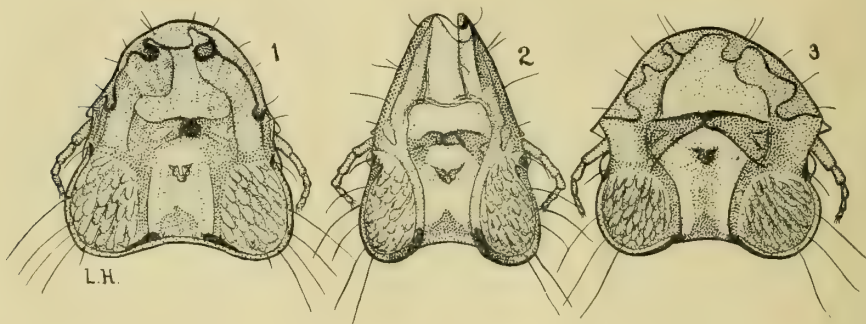
In the first place, I would suggest that the adoption of a parasitic habit by mallophagous insects occurred even as far back as late Mesozoic time. My reason for arriving at this conclusion I put forward with some hesitation, but I have not been able to suggest a better interpretation of the remarkable facts which follow. In each of the two sub-orders of Mallophaga occurs a family with a distribution confined to mammals. Each of these families is characterised, among other things, by the fact that the tarsus bears only a single claw, while all the bird-frequenting forms have two claws upon the tarsus. One of these families, the *Gyropidae*, is an offshoot from the lowest and most generalised of the bird-frequenting forms; the other, the *Trichodectidae*, from the higher and more specialised bird-frequenting forms. But coming to marsupials in Australia, there is found upon them a family of Mallophaga with two claws upon the tarsus, of which the first-described species, *Heterodoxus longitarsus*, was included by Piaget, its author (1880, p. 504), in the common bird genus *Menopon*. Even at the present time Neumann (1912, p. 359) has seen no reason to remove it from the genus *Menopon*. Unfortunately no Mallophaga from American marsupials are known, but upwards of twenty species have now been taken upon Australian marsupials (most of which are still undescribed), all belonging to the family *Boopidae* of Mjöberg (1910, p. 21), and all closely related to the lowest and most generalised bird-frequenting genus, *Menopon*. And with the exception of one or two cases which may yet be explained by straggling (Mjöberg, 1910, p. 22; Neumann, 1912, p. 364), the *Boopidae* are confined to marsupials, and they are also the only mallophagous parasites found upon them.

We find, then, upon the marsupial fauna which has been isolated in the Austro-Malayan region, what we might be justified in calling typical bird parasites. We also find in Australia, mallophagan species belonging to practically all the known bird-frequenting genera. But the marsupial parasites are most closely related to what is admittedly the most generalised bird-infesting genus. It seems more reasonable to me to suppose that the migration upon marsupials was of ancient rather than recent occurrence: and I suggest, with some hesitancy, I admit, that the *Mallophaga* took to a parasitic mode of life at a time when they had not, as a group, progressed beyond the *Menopon* condition; and that they parasitised both birds and marsupials before the true mammals had differentiated out. This, however, has no very direct bearing upon the main question at issue beyond an indication, if my supposition be at all acceptable, that we have here a case of parasitism that has accompanied practically the whole phyletic history of birds.

The actual evidence which I have to offer upon the possible clues to bird phylogeny afforded by the parasites is, at present, slender enough, but one or two instances are extremely suggestive. The general relations of parasite to host have been briefly indicated above, and illustrated by one or two examples. It is not my intention to multiply these. They have been selected quite at random, and a hundred others might equally as well have been given, so repetition can serve no purpose. From this general condition, which enables us to recognise parasites of hawks or of any other order of birds at a glance, I wish to proceed to one or two special cases. The question of the relationship of parasites of, say, hawks to those of shore birds, or passerines, will have to be left until a much more complete study has been made of *Mallophaga* in general. If this relationship can ever be stated, as I believe it may, then we shall have a clue as to the interrelation of the hosts themselves.

Of the parasites of the Struthionies, *Degeeriella asymmetrica* is found upon the emu; *Lipeurus asymmetricus* upon two species of rhea; and *Lipeurus quadrimaculatus* upon the ostrich and also upon a species of rhea. These three species are undoubtedly congeneric, and should be included in a genus distinct from either of those mentioned above. The two latter species are distinguished by a peculiar asymmetry of the chitinous border of the clypeus, the precise form of which is best seen from the accompanying text figure, from all other Mallophaga. The young of *Degeeriella asymmetrica* exhibits a precisely similar structure, which in

the adult increases in extent and becomes folded on itself in a remarkable manner, forming a V-shaped cleft, the relation of which is again more easily seen from the figure. It is hardly possible to come to any other conclusion than that these three species have been derived from a common ancestor. And we find them on hosts which admittedly have had a common origin, and which are now widely separated upon three distinct continents.

Fig. 1. *Lipeurus quadrimaculatus*.Fig. 2. *Degeeriella asymmetrica*.Fig. 3. *Lipeurus asymmetricus*—after Piaget.

Next we may profitably expand the facts given by Kellogg in the paragraph last quoted (p. 7). Upon tinamous and gallinaceous birds, two genera, *Goniodes* and *Goniocotes* are most commonly represented. We also find these two genera commonly upon pigeons; and a species of *Goniocotes* has been found upon *Opisthocomus*. The four bird groups here mentioned are, by some systematists, considered as closely related, and this relation is definitely supported by the distribution of parasites. But one more order of birds is concerned in the distribution of these two genera of parasites, and that is the Sphenisciformes, a fact that is noted without comment by Kellogg (1913, p. 141). No bird systematist has ever suggested any possible relation between the penguins and any of the other four bird-groups mentioned. Yet two mallophagan genera, characteristic of and otherwise confined to these four groups, are also found upon penguins. If the hypothesis that the five groups had origin in common be not admitted, how is the occurrence of these particular parasites on penguins to be explained? Penguins are marine, the other four groups terrestrial. I can scarcely conceive any circumstance by which penguins, with their Antarctic marine distribution, could come into sufficiently close relation with any of these other birds to allow of direct straggling to take place. Had there been a common occurrence of certain genera upon gulls or petrels and upon penguins, then straggling might be suspected. But these particular genera, *Goniodes* and *Goniocotes*, are not found upon gulls or petrels, or upon any other marine birds except penguins. And although only one or two species have been described from these last hosts, I have in my own collection other undescribed forms taken from Australian penguins, the only parasites I have taken from these birds belonging to these genera, so that the penguin habitat cannot be questioned.

In default of any better explanation, I submit that these facts of distribution point to the Sphenisciformes having an ancestral stock in common with the Tinamiformes, Galliformes, and Columbiformes. It would follow from this that the penguins have undergone a comparatively recent and rapid specialisation to an aquatic life, and are not such an ancient and lowly group as they have generally been considered. A suggestion such as this might possibly enable the morphologist to attack the problem in a new light. It could, of course, only be a suggestion. Bird phylogeny must be established upon definite morphological grounds. But if a study of the parasites gave us a reasonable series of indications of relationship, it seems probable that the morphologist, on a re-examination of his types, would be able to separate those characters of phyletic value from those which are useless from this point of view, and would be able to place our knowledge of bird relationships upon a surer footing.

I have cited these two special cases as examples of the indications which appear from a mere study of the distribution of mallophagan genera as at present constituted. Other examples might be quoted, but would serve no particular purpose. I merely wish to draw attention to certain features that exist, and to suggest the possibility of a valuable line of study. Before anything in the way of appreciable results can be achieved, a much more exhaustive examination of the Mallophaga will be necessary. Those of European and North American birds are pretty well known. Dr. T. Harvey Johnston and myself have fairly considerable Australian collections, not yet worked up. But for the rest of the world comparatively little has been done. Until more collecting, figuring, and describing has been done, it will be impossible to make satisfactory comparisons and to straighten out the inter-relationships of the Mallophaga themselves. Moreover, many of the present genera are really family groups, and until they are split up in accordance with more recent knowledge of structure they are of little use as a basis of comparison.

Work on the Mallophaga is being carried on continuously by various workers—Professor Kellogg at the Leland Stanford University; Professor Neumann at Toulouse; Dr. Mjoberg in Stockholm; Dr. Johnston and myself in Australia. I should like to suggest to those in a position to obtain Mallophaga, which are very easily collected from bird or mammal hosts, and simply preserved in tubes of alcohol, should collect these generally neglected insects, and forward them to one of the workers mentioned. By this means the gaps in our knowledge may gradually be filled.

When our knowledge of the parasites is more nearly complete, I believe that it will be possible to shed some light on bird phylogeny. There will, of course, be considerable difficulties to overcome, and some necessary precautions must be taken. The complete disappearance of important connecting links may prevent a proper understanding of Mallophagan inter-relationships. And remarkable contrasts in the rate and direction of variation of Mallophagan species will have to be in some degree accounted for. Why, for instance, has the common *Lipeurus columbae* of pigeons persisted unaltered upon practically all the Columbiformes of the world, while species belonging to other genera found upon pigeons show a considerable amount of differentiation? Many such questions will arise, the explanation of which does not seem easy. And there is also the straggling difficulty. The genus *Laemobothrium* is found upon diurnal *Accipitres*, and upon a number of waterfowl which in the ordinary course might form the food of the larger hawks. The position of the *Accipitres* is entirely unknown. Possibly there is a phyletic connection between them and the waterfowl. Equally possibly, the genus *Laemobothrium* may have straggled from one to the other, when some primitive hawk was engaged in devouring a primitive waterfowl. This straggling would seem, however, to be fairly limited. Kellogg certainly found a condition of promiscuous straggling upon the Galapagos birds, but there the conditions are quite unusual. There does not appear to be much indication of it when conditions are normal. The evidence afforded by the cuckoos is distinctly against it. In the case of these birds, the parasites can only migrate from one host to another during the very brief time occupied in copulation. Young cuckoos are much more likely to be infested by parasites of the foster parents in whose nests they are reared. But no instance has been recorded of parasites of foster parents being found upon a cuckoo, and the cuckoo parasites manage to survive as a pure stock in spite of difficulties, although comparatively few individual cuckoos are parasitized.

LITERATURE LIST.

- 1896. Kellogg—Proc. Calif. Acad. Sci., (2), vi., p. 31.
 - 1902. Kellogg and Kuwana—Proc. Wash. Acad. Sci., iv., p. 457.
 - 1913. Kellogg—Amer. Naturalist, xlvii., p. 129.
 - 1910. Mjoberg—Arkiv f. Zoologi, vi., No. 13.
 - 1912. Neumann—Arch. d. Parasitologie, xv., p. 353.
 - 1880. Piaget—"Les Pediculines, Essai Monographique," Leiden, 1880.
-

BIRD SANCTUARIES.

By A. F. BASSET HULL.

(Plate II.)

The New South Wales Birds Protection Act, 1901, provides (Sections 11 and 12):—

"Whenever any sheet of water, island, or enclosed land has been or is hereafter set apart by the Government or any private person for preserving any scheduled birds, the Colonial Secretary may, by notice in the Gazette, declare such setting apart, and may by a like notice cancel such setting apart.

"After such notice of setting apart whosoever, not being the owner thereof kills captures or injures any scheduled bird within the limits of such water, island, or land shall be liable to a penalty not exceeding five pounds."

"Scheduled bird means any bird named in the Schedule to the Act, or added thereto by notice published in the Gazette."

While this provision is not as extensive as could be wished, being limited in its application to "scheduled" birds, it could be utilised to good purpose if there were any adequate means by which lands so set apart could be properly controlled and supervised. At present, however, the public is formally notified, and there the matter ends. If areas are set apart by private owners, it is no doubt to their interest to see that the Act is respected, but Crown Lands set apart are not placed under the control of any special officer or ranger, unless they are within some park, such as the Centennial, or National Parks, where a staff is already established.

The result is that large areas, such as Lake Urana, Dugal Comer Swamp, and other "Reserves for the Preservation of Birds" are practically left to look after themselves, and no sustained local effort is made to retain even a tradition as to the reservation.

In the immediate vicinity of Sydney reserves have been proclaimed in respect of Deewhy and Narrabeen Lagoons, but there is no ranger or inspector specially appointed to watch the interests of the birds. As a consequence, on holidays, Saturday afternoons, and even on Sundays, guns are frequently used around these Lagoons, and the noble flock of Black Swans established there is becoming gradually exterminated, while a Coot, Grebe or even a Silver Gull, cannot safely feed within gunshot of the shores. If these Lakes were properly guarded for a few seasons they would become stocked with birds, and their natural attractions very largely enhanced.

On Anniversary Day, 1912, some so-called "sportsmen" shot at the flock of Black Swans on Deewhy Lagoon until they took flight. They settled in the comparatively smooth water at the northern end of Freshwater Bay, and the unusual spectacle of twenty-two swans floating within a few yards of the surf-bathers was enjoyed by hundreds of delighted holiday makers.

Mr. T. S. Palmer, Assistant Chief, United States Biological Survey, recently contributed an article to the American Museum Journal (1) on the National Bird Reservations of the United States. From this paper it appears that in 1910 an Act was passed extending protection to practically all non-game birds in the State of Florida, and in 1903 Pelican Island was reserved and set apart as a preserve and breeding ground for native birds. From this beginning the dedication of bird reservations has extended from Florida and Porto Rico in the South to Michigan, Montana, Washington and Alaska in the North, and the Aleutian Islands and Hawaii in the West. For purposes of administration these reservations are grouped into districts, and in time each district will be in charge of a supervisory officer or inspector, and probably each of the more important reservations will have a warden to protect the birds, at least during the breeding season.

(1) Amer. Mus. Journ., xiii., p. 203, 1913.

In this State much could be done, even under the present admittedly inadequate law, by enlisting the co-operation of the larger land owners, and appointing them honorary wardens of the reserves in the neighbourhood of their estates, with power to take the names of offenders with a view to prosecution. The police (who at present are the only officials who have the necessary authority) might be armed with fuller powers and provided with concise descriptions or illustrations of scheduled birds; and lighthouse keepers could be appointed wardens of the lighted Islands on the Coast.

But above all the law must be amended so as to more fully protect all birds other than game or noxious birds. Both of these classes require very considerable reduction in the number of species hitherto included in the respective categories. "Game" birds should be restricted to those actually of a substantial food value, and the smaller Doves, Bitterns, Coots, Dotterel, Gill Birds, and such species should be excluded. I would even advocate the exclusion of the Black Swan from the list of Game birds, and the placing of this handsome species on the absolutely protected list.

Many birds, hitherto regarded as "noxious," might safely be protected, for the good they do far outweighs the mischief they occasionally wreak. All the Kites, Hawks, and Eagles are such keen and active destroyers of vermin that their services in this respect should entitle them to plenary indulgence in regard to their peccadilloes amongst the lambs and chickens. Even the Crow should be protected in all coastal districts, and the Cockatoos, Parrots, Silver-eyes, and other much maligned birds, should be afforded the protection enjoyed by the average human criminal, and only punished when caught *in flagrante delicto*.

A MONOGRAPH OF THE GENUS *TISIPHONE* Hubner.

By G. A. WATERHOUSE, B.Sc., B.E., F.E.S.

(Plate 1.)

TISIPHONE Hubner.

Verzeichniss bekannter Schmetterlinge, p. 60, 1816.

Antennae less than half the length of costa, with clubs long, gradual and very slender. Eyes smooth. Forewing with vein 12 slightly, and median vein and vein 1a moderately swollen at base: vein 10 from subcostal close to end of cell: vein 6 longer than vein 5: cell more than half the length of wing. Hindwing with vein 3 and vein 4 arising well apart: cell about half the length of wing.

Type: Tisiphone abeona Donovan. *Range:* Eastern Australia.

The name *Tisiphone* was used by Hubner to include *zeline* Hubner, *pasyphae* Esp., and *tulbaghia* Linn. The first is a synonym of *abeona*, the second is a European Satyrid and the third an African species which is not a Satyrid. Scudder rightly assigns *abeona* as the type of *Tisiphone*, though this name has been often used, even in Seitz' Macrolepidoptera, for a South American genus of Satyrids with type *hercyna* Hubner, a species which was not originally included by Hubner under *Tisiphone*. Kirby in 1902 replaced the name *Tisiphone*, so far as the South American species was concerned, by *Manataria*, retaining *Tisiphone* for *abeona*: this course Fruhstorfer agrees with in the Indo-Malayan portion of Seitz' Macrolepidoptera.

The forms of *Tisiphone* have unfortunately been placed in many and varied genera. Butler in 1866 described *joanna* under *Enodia*, and in 1868 placed this and *abeona* under *Xenica*. Kirby in his Catalogue placed both under *Epinephile*, a course which was followed by Miskin in 1876 with *rawnsleyi* and by Olliff in 1888 with *helena*. Since my Catalogue (1903) Australian Entomologists have been content to use the genus *Tisiphone*.

The butterflies are very local in their habits, never wandering far from their foodplant, and are all feeble fliers. I only recognise two species, *abeona* (with its five subspecies) and *helena*, but it is more than likely that *helena* will yet be connected with *abeona* when the forms of *Tisiphone* inhabiting the coastal ranges between Rockhampton and Cairns are known.

Though its foodplant is plentiful in Tasmania, *Tisiphone* is not known from there. It is evidently more recent than such genera as *Heteronympha* and *Xenica* which occur freely in Tasmania.

TISIPHONE ABEONA Donovan.

This species has five well marked races, which agree two and two, and a highly variable intermediate race. The races in the south only differ from each other in degree, and the same is true of *morrisi* and *rawnsleyi*, but *joanna*, occupying an intermediate locality, shows in one district a gradual change from the broad orange banded *abeona* to the narrow white banded *morrisi*.

It is suggested that *Tisiphone* was originally confined to the main dividing range and became differentiated concomitantly with the changes that gave rise to the low drier area through which the Hunter River flows. To the south of this area it developed the orange banded *abeona* and *albifascia* and to the north the narrow white banded *morrisi* and *rawnsleyi*: subsequently the species was able to reach the coast, and near Port Macquarie we have, in *joanna*, the result of the fusion.

The ovum is nearly spherical, smooth and green, and laid singly on the foodplant. The eggs that produce the spring brood are laid during March and April and even in May, according to latitude and altitude. Those that produce the autumn brood are laid during September, October, and even as late as November.

The young larva is pale yellow green with faintly darker green longitudinal dorsal lines, and with the head black. In the case of *joanna*, eggs laid in October took 13-15 days to emerge. The full grown larva is yellow green with fainter longitudinal dorsal lines and with ventral surface and head pale green. The head is rough, but without horns, the forked tail is prominent and the spiracles black: the body is devoid of hairs, slightly rough, and under examination with a lens is found to be marked with minute white dots. The larvae feed upon *Cladium* (sword or cutting grass) after dark, hiding during the daytime well down in the plant. Larvae of *joanna* were fully fed at the end of four months (November to February), but specimens that produce the spring brood spend at least one month longer in the larval stage.

The nupa is smooth, bright green, with wing-cases partially outlined in bright yellow; the head is furnished with two very short horns. Pupation usually takes place on the underside of the leaves of the foodplant or on surrounding shrubs. The pupal duration of the spring brood is 18-20 days in *albifascia* and *abeona*, and 22-25 days in the spring and 18-20 days in the autumn brood of *joanna*: the females usually pupate a week later than the males and remain as pupae two or three days longer.

The perfect insects predominate during September and October, and again in March and April, though these months may be extended in either direction according to latitude and altitude. Male specimens are to be found on the wing as early as the middle of September in the coastal districts from Sydney nearly to Rockhampton; farther south they do not appear until October and in the higher portions of the main Dividing Range are not to be found until November. Freshly emerged specimens are always much darker than those that have been on the wing some time; cabinet specimens also, to some extent lose the almost black colour of examples reared from the pupae.

T. ABEONA ALBIFASCIA Waterhouse.

Plate I., Figures 23, 27, 28.

Proceedings Linnean Society N.S. Wales 1904, p. 468.

This race differs from the typical in its broader and (especially in the female) paler orange markings above, and in its broader white markings beneath: the latter character is well seen by comparing fig. 22 with fig. 23. Fig. 23 is from a male caught at Macedon Vic. 31/1/1911, and fig. 27 and 28 are from larvae taken at Macedon during October 1912 that emerged in Sydney 27 and 28/12/1912. This race is found throughout Victoria and at Eden and Pambula in southern New South Wales.

T. ABEONA ABEONA Donovan.

Plate I., Fig. 21, 22.

Insects New Holland, pl. 22, f. 1, 1805: *Tisiphone zeline*, Hubner.

Male. Above. Forewing rich dark brown: a broad central area from subcostal at half to tornus, orange: a narrow postcellular bar, orange: a subapical ocellus and a large subterminal ocellus between vein 2 and vein 3, black centred blue and with a whitish pupil. Hindwing rich dark brown: an obscure subapical and a large subternal ringed ocellus, black margined dull red.

Beneath. Forewing dark brown: markings as above but paler: ocelli as above. Hindwing dark brown: a narrow discal band, white, and traces of a double subterminal line, cream: ocelli as above, that in apex not obscured.

Female. Above and beneath as in male: bands broader and paler.

This race can always be recognised from those specimens of *joanna* that approach it, by the less prominent subternal ocellus of the hindwing above. Fig. 21 is from a male taken at Sydney 30/10/1913, and fig. 22 from a male caught in the Blue Mountains (2000ft.) 22/10/1913. This race inhabits the coast from Jervis Bay to the Hunter River, and also occurs in the Blue Mountains up to an altitude of 3000ft.

T. ABEONA JOANNA Butler.

Plate 1., Fig. 1—14, 16, 17, 18, 26, 29, 30.

Annals Magazine Natural History 1866, p. 286: l.c. 1867, pl. 4, fig. 8.

Male. Above. Forewing dark brown: a bar near end of cell, and a narrow postcellular bar, obscurely yellowish: a subterminal patch, yellowish: a small subapical ocellus and a large subterminal ocellus between vein 2 and vein 3, black. Hindwing dark brown: an obscure discal line, cream: a subapical and a subterminal ringed ocellus, black margined orange-red.

Beneath. Forewing dull dark brown: a bar near end of cell and a narrow discal band, cream: ocelli as above but margined cream. Hindwing dull dark brown: a discal and a double subterminal line, cream: ocelli as above.

The above description is drawn up from a coloured drawing of the type in the British Museum and from Butler's original description. This type specimen was received at the British Museum in 1844 from the Entomological Club and bears an old label "Linn. Soc. N. Holland." It must have been caught at one of the early settlements established in Australia, probably at Port Macquarie.

At this place (Port Macquarie) I have recently captured a long series of *joanna*, including some nearly identical with the type: but as other specimens show almost every gradation between nearly typical *abeona* and nearly typical *morrisi*, I have thought it wise to give a large number of figures; all the specimens from which these figures were engraved were caught at Port Macquarie, excepting only fig. 26, and I would draw attention to the following details:—

Fig. 1. Male. Forewing, bands pale orange, nearly as broad as in *abeona*. Hindwing with a pale orange discal band (15/10/1913).

Fig. 2. Male. Forewing, bands broad and white. Hindwing with discal band incomplete, white (14/10/1913).

Fig. 3. Male. Forewing, bands very pale orange, cell spot obscure: subterminal patch nearly divided. Hindwing with discal band prominent, cream (12/10/1913).

Fig. 4. Male. Forewing with markings prominent as compared with fig. 9 (13/10/1913).

Fig. 5. Female. Bands broad, white: corresponds to fig. 2 (emerged from pupa in Sydney 29/11/1913).

Fig. 6. Male nearly as in fig. 1: hindwing without discal band (16/10/1913).

Fig. 7. Male nearly as in fig. 2: hindwing without discal band (14/10/1913).

Fig. 8. Male. Forewing without cell spot, markings pale orange. Hindwing with discal band very indistinct (11/10/1913).

Fig. 9. Male. Forewing markings narrower than in fig. 4: this is the underside of fig. 17 (11/10/1913).

Fig. 10. Female. Markings cream (15/10/1913).

Fig. 11. Male. Forewing without cell spot: markings narrow and white. Hindwing with discal band complete, white (16/10/1913).

Fig. 12. Male. Forewing with cell spot faint: subterminal patch divided. Hindwing with discal band complete and white (11/10/1913).

Fig. 13. Male. Forewing with cell spot: markings very pale orange (14/10/1913).

Fig. 14. Female. Forewing with cell spot faint (12/10/1913).

An egg from this specimen emerged on 26th October, attached itself to pupate on 15th Feb., 1914, became a pupa on 17th Feb., and a male emerged on 6th March 1914. This male differs from the forewing of fig. 18 only in the absence of the cell spot, and agrees closely on the hindwing with fig. 11.

Fig. 16. Male. Forewing with cell spot faint: markings very close to type (12/10/1913).

Fig. 17. Male. Approaching *rawnsleyi* (11/10/1913).

Fig. 18. Male. Forewing with cell spot faint: subternal spot large and cream. Hindwing with discal band narrow and incomplete (14/10/1913).

Fig. 26. Male. Very close to *abeona*: differs in the more prominent subternal ocellus of hindwing above, which is much more prominent than shown in figure (Cooperbrook 22/10/1913).

Fig. 29. Male. Forewing markings faintly tinted orange. Hindwing markings cream (12/10/1913).

Fig. 30. Male. Markings cream (20/10/1913).

These figures are from selections from about one hundred specimens of *joanna* all taken within a few days and within eight miles of the Port Macquarie Post Office. No one type of variation was confined to a particular area of swordgrass, and orange forms were among those taken from an area on the northern, as well as from areas on the southern bank of the Hastings River. At Camden Haven twenty miles south of Port Macquarie, the only two specimens caught were orange forms, and the four specimens from Cooperbrook another twenty miles south were also orange forms and greatly resembled *abeona*; a pair from Tuncurry and a single specimen from Port Stephens also differ from *abeona* in the larger subternal ocellus on the hindwing above, and are very close to orange specimens caught at Port Macquarie.

All specimens of this race that might be mistaken for typical *abeona* may be recognised by the very prominent subternal ocellus on the hindwing above. I can find very little to distinguish two or three male specimens from the more northerly *morrisi*, excepting that they usually show a cell patch on forewing above, which I have never seen in *morrisi*, and the band of the hindwing is narrower than in *morrisi*: I have no females that would be mistaken for *morrisi*.

This race I regard as a composite one made up of every intergrade between two stable races, with the characters combined in varying degree. It is probable that this variable subspecies is confined to the coastal districts only and will not be found in the adjacent portion of the Dividing Range.

T. ABEONA MORRISI nov.

Plate I., fig. 19, 24, 25.

Male. Above. Forewing dark brown: a narrow postcellular bar and a subternal patch, white: a subapical ocellus and a large subterminal ocellus between vein 2 and vein 3, black faintly margined white. Hindwing dark brown: a broad irregular discal band, white: a subapical and a larger subternal ringed ocellus, black broadly margined dull orange-red.

Beneath. Forewing dull dark brown: a bar near end of cell, a narrow postcellular bar, and a small subternal patch, white: traces of a double subterminal line, white: ocelli as above, ringed white. Hindwing dull dark brown: ocelli and discal band as above: traces of a double subterminal line, white.

Female. Above as in male: subternal patch of forewing much broader: sometimes traces of a double subterminal line, white.

Beneath as in male: white markings broader: double subterminal lines much clearer.

Named in memory of the late J. F. Morris, B.E., through whose efforts I was enabled to capture my first specimens. This subspecies is only slightly variable: examples from Dorriggo and Ebor are larger and their white markings are broader than those from the Richmond River: one female from Dorriggo shows faint traces of a cell spot on forewing above. Fig. 19 is a female (Ballina 5/2/1898), fig. 24 is a male (Ballina 29/9/1902), and fig. 25 is also a male (Ballina 11/10/1902). This race ranges from the Bellinger River to Southport in southern Queensland, and on the Dividing Range near Ebor is taken up to 4000ft.: it has at various times been distributed as *T. joanna* Butler.

T. ABEONA RAWNSLEYI Miskin.

Plate I., fig. 15, 20.

Transactions Entomological Society, London, 1876, p. 454.

This is the most northerly race of *abeona* yet discovered. My specimens are from Caloundra, Nambour and Eumundi, all in southern Queensland: the limit of its range to the north is undetermined. In this subspecies the pale markings above have almost disappeared: only occasional females show a faint discal band on hindwing above.

Fig. 15 is a male from Nambour (Oct. 1910), and fig. 20 is a male from Eumundi.

TISIPHONE HELENA Olliff.

Proceedings Linnean Society N.S. Wales, 1888, p. 395.

Male. Above. Forewing brown, suffused golden brown: a broad discal area from costa at two-thirds to tornus, pale yellow shading to golden brown: apex, termen, and basal edge of discal band to vein 2, dark brown: a white pupilled subapical ocellus, and a large white-pupilled subterminal ocellus between vein 2 and vein 3, black. Hindwing brown: termen lined dark brown: a subapical ocellus, black, and a white-pupilled subtornal ocellus, black narrowly margined golden brown.

Beneath. Forewing as above but paler: a bar across cell at two thirds and margins of discal area to vein 2, dark brown: termen lined dark brown: ocelli as above. Hindwing brown: a basal, a discal, and a double subterminal line, red-brown: a large subapical and a subtornal ringed ocellus, black narrowly margined golden brown.

Female. Above and beneath as in male: usually larger.

This species occurs above an altitude of 1000ft., and chiefly in January and February, in the Cairns District of northern Queensland. It is usually found in the neighbourhood of *Cladium*, upon which I have no doubt the larvae feed, though I have not yet been able to discover either larvae or pupae. Its range both to north and south of Cairns is undetermined: the type came from Mt. Bellenden Kerr.

A NEW VICTORIAN ARANEIAD.

By W. J. RAINBOW, F.E.S., Entomologist to the Australian Museum.

Family ZODARIIDAE.

This family constitutes a very small section of our Australian Araneidæ. Up to the present moment two genera only have been known to occur in Australia, namely, *Cryptothele*, L. Koch, and *Storena*, Walck., and these belong to two distinct sub-families: *Cryptothelinae*, and *Zodariinae* respectively. The former sub-family embraces one genus only, and that is the one indicated; also, it is almost strictly tropical, Simon defining its geographical range as follows:—"Ins. Seychellæ (*Alluandi* E. Sim.); ins. Taprobane; penins Malayana; Nova-Guinea; ins. Latronum (*Marchei* E. Sim.); ins. Viti et Samoa. (1) To this range I add Queensland, as far south as the Blackall Ranges and some of the larger islands of the Great Barrier Reef. I have also seen specimens from around Darwin, Northern Territory.

The species of *Cryptothele* are spiders of moderate size, short-legged, sturdy, of exceedingly rugged and striking appearance, and remarkable for the hardness of their integuments; they are usually brown or earth-coloured, and with legs bunched up suggest a piece of rough bark. Only seven species of the genus are known, and of these the sole Australian representative is *C. doreyana*, Simon, a New Guinea form. On the other hand the spiders comprising the genus *Storena* are somewhat graceful; their legs are moderately long and tapering, and their colour usually shining black with pale yellowish abdominal spots or markings. These latter are usually large and very distinctive. Twenty-six species of the genus have now been described from Australia: it is a widely distributed, its geographical range being "Regio mediterranea occid. et orient; Africa trop.; Indo-China; Malaisia; N.-Guinea; N.-Hollandia; N.-Caledonia et Polynesia; Amer. septentr., æquator, et australis." (2) To the genera here enumerated I now add *Neostorena*, hereafter described.

Sub-family ZODARIINAE.

In his great classic, "Histoire Naturelle des Araignées," 2nd edition, vol. i., Simon divides this sub-family into five groups, namely, *Hermippæe*, *Storenæe*, *Suffusciæe*, *Zodariæe*, and *Paestæstineæ*, but it is not possible to place the form herewith described in any of these, hence it is necessary to establish a new group and a new genus for its reception. Briefly and succinctly stated, it comes nearest to the *Storenæe* by the number of tarsal claws (three) and the absence of an onychium, but it differs therefrom by the presence of two minute teeth on the superior margin of each falc. On page 426 of Simon's work, quoted above, the author says:—

"Les chélicèrenes offrent, comme je, l'ai dit, à la marge supérieure, une petit dent, obtuse et très reculée, qui manque aux autres Zodariides." I therefore propose a new group or section to be known as *Neostoreneæ*, with *Neostorena* as a generic name, and *N. venatoria* as its type.

Group NEOSTORENEÆ.

Genus NEOSTORENA, gen. nov.

Cephalothorax.—Convex, obovate, somewhat attenuated in front, median fovea longitudinal. *Eyes*.—Eight; in two rows of four each; both rows strongly procurved. *Legs*.—Moderately long, not strong, tapering; claws, three; relative lengths: 4, 1, 2, 3. *Palpi*.—Short, feeble. *Falces*.—Moderately long, tapering; fang small, weak. *Maxillæ*.—Short, inclined inwards. *Labium*.—Longer than broad, coniform. *Sternum*.—Shield-shaped, posterior extremity obtuse. *Abdomen*.—Ovate. *Spinnersets*.—Six; short; posterior pair much the longest, and median pair much the smallest.

¹ Simon.—Hist. Nat. des Araign.; vol. i. 2nd ed., 1892 (1893), p. 423.

² Simon.—Op. cit., p. 430.

NEOSTORENA VENATORIA, sp. nov.

Fig. 2



Fig. 1



Fig. 3

Fig. 1. *Neostorena venatoria*, Rainbow.

Fig. 2. Eyes and falces.

Fig. 3. Epigynum.

Cephalothorax ♀ 7.7 m.m. long, 5.2 m.m. broad; *abdomen*, 11 mm. long, 7.3 m.m. broad (fig. 1).

Cephalothorax.—Obovate smooth dark brown, shining. *Pars cephalica* strongly elevated and arched, sloping forward and rearward; sides declivous; a few long coarse scattered hairs spread over the surface; groove separating cephalic and thoracic segments distinct; *clypeus* deep, sloping inwards, thickly fringed with long coarse hairs. *Pars thoracica* arched, radial grooves distinct; *thoracic fovea* moderately deep, longitudinal; *marginal band*, broad, white.

Eyes.—Eight, in two rows of four each; both rows strongly procurved; front median eyes largest of the group and separated from each other by a space equal to about one-half their individual diameter, side eyes equal in size to rear median (fig. 2).

Legs.—Moderately long, tapering, upper surfaces pubescent; sides and inferior surfaces also pubescent, and sparingly furnished with a few long hairs; inferior surface of femora i. and ii. more thickly clothed than the rest; each tibia, metatarsus and tarsus armed with a series of short moderately strong spines; each femur is yellow from base to about midway, thence dark brown to apex; all other joints reddish-brown; claws, three; superior claws long, furnished at base with a comb of seven teeth; inferior claw, very small. Measurements in millimetres as follows:—

Leg.	Coxa.	Trochanter and Femur.	Patella and Tibia.	Metatarsus and Tarsus.	Total.
1	2.6	7	6.7	7.4	23.7
2	2.6	6.1	6.4	7.2	22.3
3	2.2	6	4.2	7.1	19.5
4	2.6	7.4	6.5	9.7	26.2

Palpi.—Short, not strong; femur yellowish; other joints reddish brown; thickly clothed with short, black pubescence, and sparingly furnished with a few long, black hairs; tarsi armed with a few short spines; claw long, not toothed. Measurements in millimetres as follow:—Trochanter and femur, 3.3; patella and tibia, 2.7; tarsus, 2.3; total, 8.3

Falces.—Reddish-brown, hairy, tapering; outer angle of furrow of each falx armed with two very small teeth at apex, close to base of fang; fang small, weak.

Maxillae.—Yellowish, with a large reddish-brown patch at inner angle near base; short, arched, curving inwards, apices acuminate, surface moderately clothed with coarse, black hairs.

Labium.—Reddish-brown at base, sides and apex yellow, longer than broad, coniform.

Sternum.—Rather small, broad, somewhat shield-shaped, slightly arched, yellow, sparingly clothed with short, stiff, black hairs.

Abdomen.—Ovate, slightly overhanging base of cephalothorax, dull yellowish, clouded with patches of dark brown; a rather broad, yellowish, tapering stripe commences near middle of upper surface, and terminates slightly in front of spinnerets; the surface both above, laterally, and ventrally moderately clothed with short, black hairs.

Epigynum.—Small, almost circular (fig. 3).

Spinnerets.—Six; yellow; hairy; superior pair, although not exceedingly long, are nevertheless much longer than their neighbours; they are coniform, thick at base and tapering, three-jointed, the median joint being the longest, and the apical the smallest; this pair are poised upon a rather long, broad, rounded, tubercular projection, on the superior surface of which there is, at the centre a rather thick tuft of coarse, black hairs; immediately in front of the superior spinnerets, there is a procurved row of four, and of these the two comprising the median pair are close together and are, also, exceedingly small; the outer spinnerets are short, cylindrical, their apices extending just beyond the base of the superior pair.

Hab.—Fern-tree Gully, Victoria.

NOTES ON THE BREEDING-HABITS OF THE PURPLE-STRIPED GUDGEON,

Krefftius adspersus, Castelnau.

By ALBERT GALE.

The purple-striped gudgeons in my aquarium on which the following notes are based are about five inches in length. They have become the parents of between one thousand and two thousand children during the breeding season of 1913-1914. They first bred in 1912, and were then three years old. There was but one spawning in that year, and as a result of it, I have sixteen yearlings from one and a half to two inches in length; these have all the colour markings of the adult fish, though the males are somewhat lighter in colour than the females.

In October 1913, the colouration of a pair of my gudgeons became intensified, which indicated approaching fertility. Accordingly, they were placed in an aquarium which had been prepared for them during the previous autumn, and judiciously fed, but otherwise undisturbed. The tank was of glass, with perpendicular sides, and measured thirteen by fourteen inches on the surface of the water, which was thirteen inches deep. To make the conditions as natural as possible it was well supplied with water-weeds and pond-snails, and the anchorage for the plants was composed of shell-grit, sand, and humus, no clayey matter being introduced.

Early in the breeding season (15th November), the female deposited her first batch of eggs on the glass side of the aquarium, and others again on the 18th and 27th of December. In the following month, January 1914, she spawned on the 7th, 17th, and 30th, and now in March she has her tenth lot of eggs. Since last October the male has been tending the various batches of eggs for ninety days.

The following observations are based on one spawning only, that of February 17th. The details were obtained twice each day, at 9 a.m. and 9 p.m., with occasional intermediate visits. The evening visits were the most instructive, being made by the light of two or three candles placed on the side of the aquarium opposite that on which the eggs were deposited, which clearly illuminated them, as well as the movements of the parent fishes.

On the 15th and 16th, the male made preparations for the deposition of the ova by removing confervoid growths and all foreign matter from the selected site. These he carefully cleared away with his mouth. Meanwhile the female lurked in the weeds on the far side of the aquarium. At 9 a.m. on the 16th, she visited and inspected the site. Approving of it, she placed herself in a horizontal position by it, her abdomen lying at an angle of about forty-five degrees, so that the genital papilla had free play to eject the ova on to the glass. Her position also gave me a clear view of her every movement. When his mate had settled herself, the male drew near, and took up a position about one inch above her. His head pointed in the opposite direction to hers, and his abdomen lay at right angles to the prepared site; his genital papilla was immediately above that of the female.

On the morning of February 17th, the first ovum was emitted, and immediately afterwards, two others followed. These were conjoined by a fine hair-like film, and were closely followed by a string of eight. She continued to eject strings of eggs until a circular patch of about two by two inches was covered. All the chains of eggs were placed horizontally, no one crossing another, and there were about twenty eggs to the lineal inch. Each egg had a gelatinous base by means of which it adhered to the glass. As the ova were being deposited, the male hovered over the female, it being evident from the movements of his genital papilla that the spermatric fluid was being ejected, and fertilization taking place.

The spawning being completed, the male at once placed himself perpendicularly above the ova, frequently changing his position, his head being sometimes up, at others down. He remained over the eggs for nine days, the period of incubation, and I suppose he obtained his food at night, as he was never feeding at the time of my visits. In thirty-six hours the gelatinous base of each egg had become elongated into a peduncle, the eggs themselves being also larger, and provided with a globule of air on the yolks. On the third day he commenced to fan them continually by oscillating his pectoral and caudal fins. These actions kept the ova in a constant swirl, and were continued until the fry emerged and took shelter in the weeds.

On the morning of the 20th, I noticed the first signs of eyes, and at 9 p.m. they were distinctly visible. On the 25th at 9 a.m., the fry were emerging from the eggs, nine days after their deposition. For a while they hung head downwards from the empty egg-capsules by means of their tails, which were bent like the curve of a fish-hook. The motions of respiration and a tremulous movement of the pectoral fins were the first indications of life when they came into the world. At 8 p.m. the following day they had all dispersed among the weeds, where they were further guarded by the male for another twenty-four hours. The temperature of the water at this time was about eighty degrees.

There were no sterile eggs in the first few nests, the first one being observed in the fourth. The eighth nest contained thirteen, and the number continued to increase as the season advanced.

A NEW AUSTRALIAN CAPRELLID.

By the Rev. THOMAS R. R. STEBBING, M.A., F.R.S., F.L.S., F.Z.S.

(Communicated by Allan R. McCulloch.)

Fam. CAPRELLIDAE.

Gen. PARAPROTO, Mayer.

1903, *Paraprote*, Mayer, Siboga-Expeditie, vol. 34, pp. 12, 24.

From Slabber's *Phtisica*, for which Mayer uses the later name *Proto*, the present genus is distinguished by having only the third and fourth segments of the peraeon furnished with branchial vesicles, the third peraeopod with the normal number of joints, and only two pairs of pleopods. It was instituted to receive the two Australian species described by Professor Haswell in the Proceedings of the Linnean Society of New South Wales, vol. 9, pt. 4, pp. 993, 998, under the names *Proto condylata*, and *Proto spinosa*, the date of publication being 1885. They were noticed under the original names by Mayer in 1899, and again in 1903 with additional figures and comments under the new generic title. The two species are distinguished one from the other and from the species about to be described by well marked characters. But at the same time the new species rather curiously combines some of the features by which the other two are kept apart.

PARAPROTO GABRIELI, n. sp.

(Plate III.)

The head is smooth, the only segment of the peraeon with a conspicuous spine-like dorsal process is the second, the three following segments being slightly raised in the middle of the back. The second has a spine also on each side above the insertion of the gnathopods. The eye is small. The first antennae have the first joint two-fifths the length of the second, the much more slender third joint is three-fourths as long as the second, and the flagellum of some thirty joints nearly equals the first and second joints of the peduncle combined. The second antennae are slender, not much shorter than the peduncle of the first, the last joint of the peduncle two-thirds the length of the long penultimate joint, the flagellum of sixteen or seventeen joints being rather longer than both combined.

The mouth-organs, as will be seen by the illustrations, are very like those of *Phtisica*, in accord with Mayer's definition of the genus.

The first gnathopod is of the ordinary type; the second in general appearance resembles that of the adult male in Haswell's smooth-bodied *P. condylatus*, with the large hand distally produced beyond the insertion of the finger, but whereas in Haswell's species the fifth joint or carpus is as usual very small, here it has the rare character of being elongate, being more than half the length of the long and much broader hand. The commencement of the palm is marked by an outstanding tooth followed by a rounded tubercle and accompanied by spinules, many more or less minute pairs of which attend the very sinuous margin to the hinge of the finger.

The first and second peraeopods are alike, having the fourth joint two-thirds the length of the long second, and about as long as the three following joints combined; the sixth joint has on the inner margin three outstanding spines proximally, more conspicuous than those which follow. These limbs are much shorter than the second gnathopods, not of the same length as in the two species described by Haswell. The branchial vesicles are long and slender, slightly but conspicuously twisted, thus making an interesting approach, by convergence, to the spirally contorted branchiae in *Cyamus scammoni*, Dall. Though this twisting is not described for the branchiae of the earlier species of *Paraprote*, it is indicated in Haswell's figure of *P. spinosus*. On the other hand in his *P. condylatus* these branchiae are shown by Mayer's figure to be perfectly simple. The third peraeopods, though normal in the number of joints, are very short,

about half as long as either of the two preceding pairs. The fourth pair are missing from the single specimen. The fifth pair are stouter than the first, and somewhat longer though their second joint is not so long, being little longer than either the fourth, fifth, or sixth; the sixth has two pairs of spines at the end of the palm which is reached by the long slender finger.

The small pleon carries two pairs of two-jointed pleopods.

Length of the specimen 22 mm. from front of head to end of pleon, of first antennae about 16.5 mm., of second gnathopod 18 mm.

Locality.—Western Port, Victoria, dredged among seaweed in 2-4 fathoms. This is the place at which *P. spinosus* was met with.

Mr. Allan R. McCulloch, to whom I am indebted for the opportunity of describing the specimen, tells me that it was collected by his friend Mr. Joseph Gabriel, whose name I therefore have the pleasure of using for the new species.

Description of Plate III.

Paraproto gabrieli, n. sp.

n.s. Rough sketch of specimen, natural size.

C. Cephalon with first segment of the peraeon and part of the second.

Pl. Pleon with pleopods.

a.s., a.i. First and second antennae.

l.s., m., mx. 1., 2., mxp. Upper lip, mandible, first and second maxillae, maxilliped.

gn. 1., 2., prp. 1., 3., 5. First and second gnathopods, first, third, and distal part of fifth peraeopods.

The head, pleon, antennae, and limbs are magnified to a uniform scale.

The mouth-organs are also on a uniform but much higher scale of magnification.

NOTES ON SOME AUSTRALIAN PIPE-FISHES.

By ALLAN R. McCULLOCH, Zoologist, Australian Museum.

I. The remarkable sexual dimorphism of *STIGMATOPHORA NIGRA*, Kaup.

(Figures 1-3.)

During the recent Easter encampment of the Field Naturalists' Club of Tasmania, a small collection of fishes was made which includes two species of *Stigmatophora*, *S. argus*, Richardson and *S. nigra*, Kaup. They are each represented by ovigerous females and males with their pouches filled with more or less developed eggs. The specimens of *S. argus* do not offer any very striking differences in the form of the body in the two sexes, but in *S. nigra* the male is subcylindrical and almost without ornamentation, while his mate is broad and depressed, with rich pink and black markings. They are so dissimilar in their appearance that one can only be sure of their specific identity after a critical comparison of all their characters.

As is usual in the family *Syngnathidae*, the males each have a well-developed brood-pouch, which is placed on the lower surface of the tail behind the vent (fig. 3). It opens along the median-line, and eggs, or young in an advanced stage of development can be seen within. The latter are closely curled within the egg-capsules, but when extracted and laid out straight they measure about 11 mm. in length. They have large heads with enormous black eyes, and their snouts are very short and broad; their bodies are transversely banded with bars of blackish pigment spots. The females, on the other hand, have no brood pouches, but if the abdomen be opened, ovaries containing large eggs are seen on either side of the body near the vent.

STIGMATOPHORA NIGRA, Kaup.

Stigmatophora nigra, Kaup, Cat. Lophobr. Fish. Brit. Mus., 1856, p.53. *Id.*, Gunther, Brit. Mus. Cat. Fish., viii., 1870, p.190. *Id.*, Castelnau, Proc. Zool. Soc. Vict., i., 1872, p.201, and ii., 1873, p.39. *Id.*, Castelnau, Vict. Offic. Rec. Philad. Exhib., 1875, p.48, and Proc. Linn. Soc. N.S. Wales, iii., 1879, p.355. *Id.*, Macleay, Proc. Linn. Soc. N.S. Wales, vi., 1881, p.297. *Id.*, Johnston, Proc. Roy. Soc. Tasm., 1882 (1883) p. 134, and 1890 (1891), p.37. *Id.*, Duncker, Faun. Sudwest-Austr., ii., 1909, p.239. *Id.*, Ogilby, Mem. Qld. Mus., i., 1912, p.36.

Stigmatophora boops, Castelnau, Proc. Zool. Soc. Vict., i., 1872, p. 203. *Id.*, Macleay, Proc. Linn. Soc. N.S. Wales, vi., 1881, p.298.

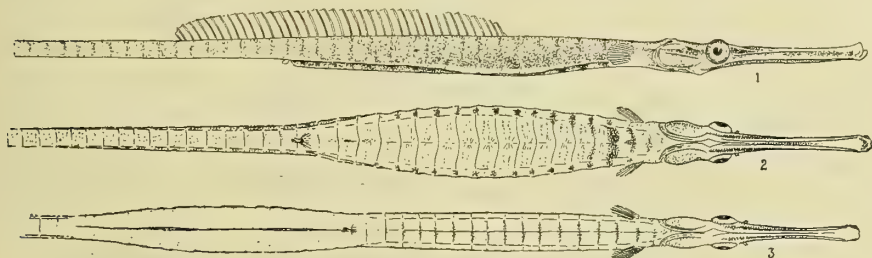


Fig. 1. Side view of female.

Fig. 2. Ventral surface of female.

Fig. 3. Ventral surface of male.

D.36-43. Body segments 16-18. Head 2.3-2.8 in the length from the tip of the snout to the vent. Head and body 1.3-1.7 in the tail; the latter longer in males than in females. Snout 0.6-1.0 longer than the rest of the head. Dorsal fin placed on eleven or twelve body-rings, and six to eight tail rings; the position of the vent is well behind the middle of its length. Pectoral short and broad, a little longer than the eye, which is half or slightly less than half the postorbital portion of the head. A minute anal fin is present in both sexes. Operculum crossed by a horizontal ridge. Nostrils close together, near the eye, the anterior tubular. Snout with a few raised ridges, none of which are prominent.

Male.—Body subcylindrical, scarcely broader than deep, with the angular ridges but little elevated. The pouch is large, and occupies fifteen to eighteen tail-rings. Colour: pale green, closely speckled with microscopic black dots. Each segment of the abdomen with a more or less distinct patch of black dots on the median line. Lower surface of snout with two longitudinal dark bars extending backward to behind the eye.

Female.—Body strongly depressed, adults being twice as broad as deep; the sides are produced outwards into a sharp edge. The other angular ridges are but little elevated as in the male. Colour: upper surface pale green closely speckled with microscopic black dots which are largest on the sides where they almost coalesce. Outer edge of expended sides and abdomen deep pink, the latter crossed by pale blue lines which bear minute black dots. Breast with one or two broad dark cross-bars which are represented on each abdominal segment by a black dot placed near the margin on either side. Tip of snout white, chin pink; lower surface of snout with two dark longitudinal bars extending back behind the eyes.

S. argus differs from the specimens described above in having a much larger number of dorsal rays, and the vent being placed under or before the middle of the dorsal fin. The snout is also more than twice as long as the rest of the head, and the colour marking is very different.

Locality.—Thouin or Wineglass Bay, Tasmania, 11 fathoms; 13th April, 1914.

II. Description of a new genus and species.

Genus HISTIOGAMPHELUS, gen. nov.

This genus differs from *Syngnathus* chiefly in the development of a high ridge on the upper surface of the short snout. Dorsal placed above the vent, its base elevated above the back. Tail longer than the head and body, quadrangular, with a well developed caudal fin. Large pectorals and a minute anal fin present. Upper ridge of the body not continuous with that of the tail, which overlaps but does not join the mediolateral ridge. Latero-inferior ridge of the body continuous with that of the tail. No ridge on the operculum.

Type.—*H. briggsii*, sp. nov.

HISTIOGAMPHELUS BRIGGSII, sp. nov.

(Fig. 4.)

D.23; P.13; C.10; Body-rings 22; Tail-rings 36. Head 4.6 in the length from the tip of the snout to the vent. Snout three-fifths as deep as long, 1.1 in the remaining part of the head. Eye 2.5 in the snout. Tail 0.3 longer than the head and body. Caudal fin 3 in the head.

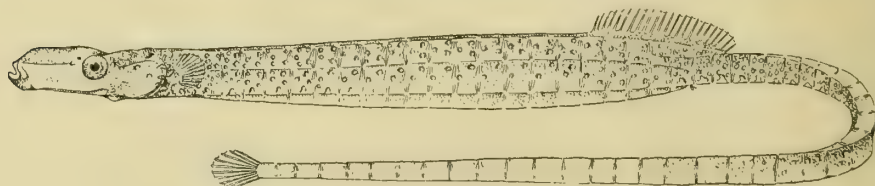


Fig. 4.

Body with seven distinct but smooth ridges, the abdominal one being very prominent. The latero-superior pair terminate at the hinder base of the dorsal fin. The medio-lateral ridges extend backward to the last body ring, and terminate beneath the anterior ends of the upper caudal edges. The latero-inferior body ridges join the lower caudal edges. The body is much deeper than wide, its greatest depth being somewhat before the dorsal fin; the back is slightly convex so that the base of the dorsal is elevated.

Snout short and thick. The median elevated ridge commences on the upper lip, and extends back to above the middle of the eye; it is thin and flexible, and its upper margin is entire and slightly concave. A low smooth ridge defines the lower margin of the snout on either side. Nostrils close together near the eye, the anterior tubular. Top of head and nape with a very low ridge which is lost on the first body ring. Operculum with fine radiating striae.

Dorsal fin placed above five body rings, and two tail rings. Pectoral and caudal well developed; a minute anal fin is also present.

Colour.—Rich orange brown, with numerous dark edged, blue ocelli

Described from an adult female 235 mm. long, which is deposited in the Tasmanian Museum.

Locality.—Dredged in eleven fathoms in Thouin or Wineglass Bay on the east coast of Tasmania; 13th April, 1914. Collected by Mr. E. A. Briggs, after whom the species is named.

HISTIOGAMPHELUS CRISTATUS, Macleay.

Leptoichthys cristatus, Macleay, Proc. Linn. Soc. N.S. Wales, vi., 1881, p.296.

Leptoichthys (?*Doryrhamphus*) *cristatus*, Duncker, Faun. Sudwest-Austr., ii., 1909, p.234.

I have examined the type of this species in the Macleay Museum, and have little doubt that it is generally identical with *H. briggsii*. It is in very bad condition, being largely decayed, and the anterior half of the head and the abdomen are entirely lost. So far as can be ascertained, it agrees with Macleay's description in all but one detail; instead of the upper edge of the body passing that of the tail by one ring as described, they really overlap on two and a half rings. The medio-lateral ridge and the upper caudal edge terminate on the same ring, the latter being over the other. Length from posterior margin of operculum to vent 40 mm.; vent to base of caudal fin 57½ mm.

Locality.—West Australia.

BIRD NOTES FROM THE NORTH-WEST OF NEW SOUTH WALES.

By WALTER W. FROGGATT, F.L.S., Government Entomologist.

While engaged in my official work in the Brewarrina district during the last six months, I have had many opportunities of observing the habits of the birds and animals on the Salt-bush plains, and along the banks of the Barwon River. Galahs, *Cacatua roseicapella*, are very plentiful all over the open forest and scrub country, and as no one ever shoots them, they are remarkably tame. When they are feeding upon the berries which fall in large quantities from the *Loranthus* bushes, parasitic on the Bolar trees, *Casuarina* sp., we can often walk up to within ten yards of a flock of them before they take flight. Sometimes a flock of fifty or more will camp for the night in the trees close by our tents. They have a curious way of talking or grumbling to themselves in a low tone, often for an hour or more, before they go to sleep.

When they come to slake their thirst at the waterholes, which, in the hot summer days, they do at about noon and just before sunset, they are very fond of alighting on any post or stump that may be in the water. They crawl down it to drink, and look very comical when half a dozen together are all "standing on their heads."

Galahs nest in hollow trees, which are generally well grown gums in the billabongs and gillies. In Lucas and Le Souef's "Birds of Australia," the authors say they "generally peel the bark off the branch just under the nesting hole, which makes the site conspicuous." Now, though there must be thousands of nesting holes all over our district, I have only noted half a dozen of these barked tree stems. In these cases they were bent or curved limbs, and the bark was stripped off an area a foot wide and two feet long, just below the openings leading into the nests; the branch was never ring-barked right round. Under a freshly-barked branch the fine strings or shavings formed a regular heap. The bushman say the birds strip off the bark to make the stem so smooth that the goanas or monitor lizards, cannot climb round the stem to rob the nest. As these lizards are not very plentiful in this scrub country, it is probable that the galahs only resort to this method of protecting their nesting places when they actually find them in their localities.

During the last two months, March and April, 1914, good falls of rain have brought on plenty of fresh grass and green herbage all over the north-west country along the Barwon River, and into southern Queensland. South of Byrock, on to Bourke, and southwards, dry conditions still prevail, and there is little or no green feed. Through some wonderful instinct, or wireless telegraphy of the bird-world, the emus of the south west have learnt of the good times prevailing farther up, so they are gathering together and trekking northward. While travelling on the train between Nyngan and Byrock, on March 30th, I counted seventy-five emus in small flocks of four to thirty, all making in the one direction across the line. On my return a week later, I saw eighty more going the same way, and getting through the railway fences on their journey. On making enquiries, several station owners informed me that there was a regular movement of the emus over a very large area south of the railway line.

The very interesting and friendly Apostle Birds, *Struthidea cinerea*, are known under a number of popular names, but none fits them so well, I think, as that of the Happy Family, bestowed upon them by bushmen. One of their names, Grey Jumpers, is most misleading for they are certainly not grey, and they do not jump. There is hardly a waterhole or tank we visit where we do not find them in possession, their number varying from five to fifteen, and at our camp there is a family of nine which adopted us as soon as our tents were in position. They are often away during the day, but they invariably return before sunset, and they have learnt to know our meal hours, and come around the dining tent. Though they will not as yet take food out of our hands, they come to within a foot of us to pick up bread and scraps, which they generally carry off a few yards before eating. They found where our bags of horse-feed were stored under a shed, and picked holes through them to get at the grain. Where some ant mounds had been fumigated and dug up, they spent a profitable time for several days, scratching over the nest like a lot of chickens, and eating the dead ants and pupae.

Some time ago, in the height of the rabbit plague, the squatters wired in all the tanks and water frontages, and set out poisoned water for the pests. All the birds which flew direct to the tanks to drink escaped this death-dealing lure, but several species which had the precautionary habit of alighting a short distance away walked to the poisoned water first, and so died. Among those that suffered most were doves, bronze-wing pigeons, and happy families. All these, however, appear to have bred well since for they are now plentiful wherever there is water in the back country.

AN INTERESTING EXHIBIT.

By A. S. LE SOUEF, Director, Zoological Gardens.

(Plate IV.)

There is on exhibition at the Society's Gardens, Moore Park, an exceedingly interesting specimen of a male Chimpanzee, *Anthropopithecus troglodytes*, Linnaeus. This fine animal is now fully grown, and is about seven years old. He is of a lively and playful disposition, and since his introduction into the Gardens, has proved a source of much attraction to visitors. His general health is, to all appearances, excellent, and his diet, which he thoroughly enjoys, is a mixed one; it consists of fruit, vegetables and cooked meat, while in respect of a good hot curry he is decidedly an epicure. The animal weighs 158 pounds, and his measurements, which are given in inches, are as follows:—

Height, as standing in picture 50; along body curves 59; circumference of chest 40; waist 35; arm, from top of shoulder to tip of forefinger, $33\frac{1}{2}$; hand, from wrist to tip of forefinger, $9\frac{1}{2}$; leg, from top of femur to tip of large toe, 31; foot, from heel to tip of large toe, $14\frac{1}{4}$; circumference of calf of leg 15; thigh $22\frac{1}{2}$.

The photograph on the accompanying plate is of particular interest as showing that the Chimpanzee can assume a semi-upright position; it also illustrates the alignment that can naturally occur in the big toe as shown in the right foot.



Tisiphone abeona, Donovan. Nine-tenths natural size.



A. F. BASSET HULL, photo.

Silver Gulls on Montague Island, New South Wales, which is not a "Reserve."



T. R. R. STEBBING, del.

Paraproto gabrieli, n. sp.



Chimpanzee *Anthropopithecus troglodytes*.

CONTENTS OF PART I.

	PAGE
Report of the Council for 1913 	1
The Mallophaga as a possible clue to Bird Phylogeny, by Launcelot Harrison, B. Sc.	7
Bird Sanctuaries, by A. F. Basset Hull 	13
A Monograph of the genus <i>Tisiphone</i> , Hubner, by G. A. Waterhouse, B. Sc., B.E., F.E.S. 	15
A New Victorian Araneiad, by W. J. Rainbow, F.E.S. 	21
Notes on the Breeding-habits of the Purple-striped Gudgeon, <i>Krefftius adspersus</i> , Castelnau, by Albert Gale 	25
A New Australian Caprellid, by the the Rev. Thomas R. R. Stebbing, M.A., F.R.S., F.L.S., F.Z.S. 	27
Notes on some Australian Syngnathidæ, by A. R. McCulloch 	29
Bird Notes from the North-west of New South Wales, by Walter W. Froggatt, F.L.S.	33
An Interesting Exhibit, by A. S. Le Souëf, Director, Zoological Gardens 	35

1915
Mar 20/15

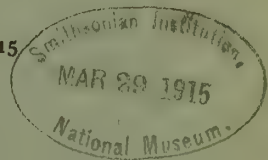
THE AUSTRALIAN ZOOLOGIST

Issued by
The Royal Zoological Society of New South Wales.

Edited by
ALLAN R. McCULLOCH,
Zoologist, Australian Museum

Vol. 1.—Part 2.

Sydney, 22nd February, 1915



SYDNEY.
W. E. SMITH LIMITED, PRINTERS.

Royal Zoological Society of New South Wales

ESTABLISHED 1879

COUNCIL AND OFFICERS, 1915.

President :

Lt.-Colonel Alfred Spain, V.D., F.I.A.

Vice-Presidents :

Charles Hedley, F.L.S.

A. F. Basset Hull.

Albert E. Nash.

R. H. Todd, M.D., F.R.C.S.I.

Members :

Major John Spencer Brunton.

T. W. Keele, M.Inst.C.E.

Sydney Dodd, D.V.Sc., Dr. V.Sc.

Allan R. McCulloch.

W. W. Froggatt, F.L.S., F.E.S.

W. J. Rainbow, F.E.S.

H. E. Finckh.

J. M. Smail, M.Inst.C.E.

A. E. Jaques.

S. T. D. Symons, M.R.C.V.S.

Sydney Jamieson, M.D.

G. A. Waterhouse, B.Sc., B.E., F.E.S.

Hon. Treasurer :

W. J. Green.

The Representatives of the Government :

The Hon. Frederick Flowers, M.L.C.

The Hon. H. C. Hoyle, M.L.A.

Aldermen of the City of Sydney :

Alderman L. H. Lawrence.

Alderman W. J. Walker.

Director :

A. S. Le Souef, C.M.Z.S.

Auditors :

Messrs. L. S. Drummond and Co.

Superintendent :

R. K. Spencer.

The Report of the Council

OF THE

Royal Zoological Society of New South Wales

FOR THE

YEAR ENDED DECEMBER 31st, 1914.

THE Annual General Meeting of the Society was held on February 21st, at the Royal Society's Hall, at which the following retiring Members of the Council were re-elected:—Major J. S. Brunton, W. W. Froggatt, W. J. Green, L. Harrison, A. E. Nash, and S. T. D. Symons.

At a meeting of the Council held subsequently the following Office-bearers were elected:—President, Colonel A. Spain; Vice-Presidents, A. F. Basset Hull, Charles Hedley, Dr. R. H. Todd and A. E. Nash; Treasurer, W. J. Green. Mr. L. Harrison resigned from the Council in October, in consequence of taking up his residence in England. He was elected a corresponding member of the Society. Mr. G. Athol Waterhouse was elected to the vacancy.

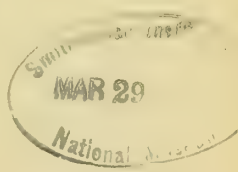
Attendance of Members of the Council at Meetings during 1914:—Major J. S. Brunton, 5; Dr. Sydney Dodd, 8; ; H. E. Finckh, 9; W. W. Froggatt, 4; W. J. Green, 10; L. Harrison, 4; Charles Hedley, 8; A. F. Basset Hull, 10; Dr. Sydney Jamieson, 7; A. E. Jaques, 5; T. W. Keele, 7; Allan R. McCulloch, 10; Albert E. Nash, 2; W. J. Rainbow, 8; J. M. Smail, 3; Colonel A. Spain, 11; S. T. D. Symons, 4; Dr. R. H. Todd, 11; G. A. Waterhouse, 2.

Mr. Nash and Mr. Harrison were granted leave of absence, and Mr. Waterhouse was only elected in November.

ATTENDANCES.

A total of 231,660 people visited the Gardens during the year; this shows a falling off of 64,028 as compared with the figures for last year. The primary causes were the increase of the city tram fares on Sundays, continuous wet weather, and, to a lesser extent, the unsettled conditions of the last four months of the year, owing to the war. Details of the attendance are as follow:—

Sundays, Adults.....	60,616
" Children.....	29,001
Week Days, Adults.....	93,935
" Children.....	41,266
Schools.....	1,742
	<hr/>
	231,660



ANIMALS.

The collection has been kept well up to standard, several large animals having been added. These include a splendid pair of American Bison, very generously presented to the Society by Mr. A. B. Spreckles, of San Francisco. The principal purchases were a well-grown pair of Canadian Wapiti and a large Black Bear, while others include Tree Porcupines, Ocelot, Badgers, Peccaries, Rheas, Barking Deer, European Cranes and Macaws, besides many Australian animals, birds and reptiles.

The births include a Bactrian Camel, Indian Antelope, Dorcas Gazelle, Rusa Deer, Timor Deer, Axis Deer and Hog Deer, Zebu, and several Kangaroos and Wallabies. The young Bactrian Camel is an acquisition; although neglected by its mother it has been successfully reared by hand. In the large aviary several birds successfully reared their young—notably Wonga Pigeons, Squatter Pigeons and Blood-Breasted Pigeons, Golden-Shouldered Parrots and Blue Wrens. It is satisfactory to note that the rare Golden-shouldered Parrot can be bred in captivity.

The following animals were born and reared in the Gardens during 1914:—

1 Arabian Gazelle	1 Agile Wallaby
1 Indian Antelope	1 Grey Kangaroo
1 Timor Deer	1 Rat Kangaroo
1 Axis Deer	5 Blood-Breasted Pigeons
1 Rusa Deer	3 Golden-Shouldered Parrots
2 Hog Deer	1 Wonga Pigeon
3 Angora Goats	2 Squatter Pigeons
1 Bactrian Camel	9 Blue-Tongued Lizards
1 Bennett's Wallaby	14 Water Tortoises

335 Specimens were presented to the Society, and the Council is much indebted to the donors; 124 were purchased, 10 deposited, and 94 were received in exchange. 152 animals were sold, 206 sent in exchange, and 15 were placed on deposit at various Government Reserves by the Council. The value of the collection on December 31st was estimated at £4,310 17s. 5d.

During the year two consignments of Starlings were sent to the Moree district to assist the station owners in combating the Sheep Fly, while several hundred have been ordered for other parts of the State, to be delivered next season.

Three pairs of Laughing Jackasses were sent to the east coast of New Zealand for acclimatisation purposes, and several Opossums to Norfolk Island.

GENERAL.

The incorporation of the Society, which has been under consideration for some time, was again brought before the notice of the Government, who stated that owing to the pressure of business they were unable to deal with it, and advised that the Society be registered.

There are now 130 Financial Members of the Society, being an increase of 36 on last year, which is very satisfactory. Members are nevertheless requested to endeavour to induce others to join the Society in order that its aims may be furthered. It may be pointed out that in addition to the right of entry into the Zoological Gardens at Moore Park, Members are now enabled to take small parties over the extensive grounds at Taronga Park.

From the intimate association of the Society with the Taronga Zoological Park Trust, it will interest Members to know that good progress has been made in preparing the Park for the reception of a Zoological collection. A large portion of the ground of fifty acres has been cleared, roads have been made, and a very large number of trees, shrubs, palms and ferns have been planted. A sufficient grant of money is now required to prepare the Park for the reception of animals and birds. A large flight aviary and six enclosures for monkeys have been completed during the year.

In February the following motion was passed by the Taronga Park Trust:—"That Members of the Royal Zoological Society of New South Wales have permission to enter Taronga Park, accompanied by two adults or four children, on presentation of their ticket of membership."

Equitable Building,

George Street,

Sydney, 27th January, 1915.

THE COUNCIL,

THE ROYAL ZOOLOGICAL SOCIETY OF NEW SOUTH WALES,

MOORE PARK,

SYDNEY.

DEAR SIRS,

We have to report the completion of the Audit of the Books and Vouchers of the Society for the year ended 31st December, 1914, and have certified to the accompanying Statement of Receipts and Disbursements as being in accordance therewith.

With a few exceptions, all vouchers have been sighted by us, and the production of those missing is promised in due course.

RECEIPTS.

The Receipts of the Society for the year 1913, as set out in detail on the attached Statement, totalled.....	£6036 14 6
The Receipts for the year 1914 were.....	5794 10 5
Being a decrease of.....	<u>£242 4 1</u>

DISBURSEMENTS.

The Expenditure for the year 1913 totalled.....	£6822 17 5
The Expenditure for the year 1914 totalled.....	6191 5 1
Being a decrease of.....	<u>£631 12 4</u>

It will be seen from the Statement of Receipts and Disbursements that the difference between the Bank Overdraft and Cash on Hand, etc., at 31st December, 1913, amounting to a net overdraft of £24 19s., has increased to £421 13s. 8d. at 31st December, 1914, being a further deficiency of £396 14s. 8d., representing the excess of disbursements over receipts during the year ended 31st December, 1914.

The Royal Zoological Society of New South Wales

STATEMENT OF RECEIPTS AND DISBURSEMENTS FOR THE YEAR ENDED

31ST DECEMBER, 1914.

RECEIPTS.		DISBURSEMENTS.	
Jan. 1, 1914—		Jan. 1, 1914—	
To BANK BALANCE.		By Bank Overdraft—	
Directors' Trust Account.....	£19 19 1	General Account.	£167 19 5
Add Amount to be Refunded by New Zoo Trust.....	1 3 5	Dec. 31—	
	£21 2 6	By Salaries and Wages	£3249 9 7
.. Cash on Hand.....	105 6 1	„ Improvements to Premises.....	13 8 3
„ Petty Cash on Hand	16 11 10	„ Maintenance of Premises.....	441 11 5
	121 17 11	„ Purchase and Transport of Animals..	362 18 8
Dec. 31—		„ Maintenance of Animals.....	1461 5 10
„ Government Grant.	999 19 8	„ Advertising.....	307 1 8
„ Gate Receipts.....	3771 2 2	„ Office and Printing Expenses.....	181 12 9
„ Elephant Rides....	295 16 7	„ Incidentals.....	164 4 11
„ Subscriptions.....	93 19 6	„ Bank Interest.....	9 12 0
„ Sale of Animals....	210 12 10		6191 5 1
„ Sale of Hides, Skins, etc.....	117 2 6	„ BANK BALANCES—	
„ Rents.....	164 0 0	Directors' Trust Account.....	6 3 10
„ Fines.....	28 6 11	Add Amount to be Refunded by New Zoo Trust.	3 8 4
„ Hire of Camel.....	4 0 0		9 12 2
„ New Zoo Trust on a/c Loan	100 0 0	City Bank of Sydney, No. 2 A/c..	53 12 8
„ Sundries.....	3 14 9		63 4 10
„ Advertising in Guides	3 3 0	„ Cash on Hand.....	23 5 6
„ Sale of Guides.....	2 12 6	„ Petty Cash on Hand	21 12 8
„ Bank Overdraft—			44 18 2
General Account.	529 16 8		£6467 7 6
	£6467 7 6		

We have examined the Books and Vouchers of the Society for the year ended 31st December, 1914, and certify the above statement to be in accordance therewith.

L. S. DRUMMOND & CO.,

Incorporated Accountants.

Sydney, 27th January, 1915.

LIST OF MEMBERS, 1914

HONORARY :

Green, Capt. Chas.....	"Mount Stewart," Reid Street, Neutral Bay, Sydney
Gale, Mr. Albert.....	Sebastopol Street, Marrickville
Hackett, The Hon. Sir J. Winthrop, D.C.I....	Perth, Western Australia
Johnstone, Dr. T. Harvey.....	The University, Brisbane, Queensland
Le Souef, Mr. E. A.....	Zoological Gardens, Perth, West Australia
Le Souef, Mr. W. H. D.....	Zoological Gardens, Melbourne, Victoria.
Minchin, Mr. A.....	Zoological Gardens, Adelaide.

CORRESPONDING MEMBER :

Harrison, Mr. Launcelot, B.Sc.	Cambridge University, England.
-------------------------------------	--------------------------------

LIFE MEMBERS :

Alderson, Mr. L.....	Mutual Life Insurance Society, Sydney.
Belisario, Mr. E.....	Grosvenor Street, Woollahra.
Bennett, Mr. F. Owen.....	29 Waverley Street, Waverley.
Bennett, Mr. John.....	9 Glen Street, Milson's Point
Bond, Mr. Albert.....	131 Pitt Street, Sydney.
Chalmers, Mr. G.....	76 Pitt Street, Sydney.
Cohen, Mr. George J.....	"Eugadine," Elizabeth Bay.
Cox, Mr. E. Standish.....	Fewing Street, Randwick.
Dibbs, Mr. T. A.....	Edward Street, North Sydney.
Finckh, Mr. H. E.....	"Hermes," Raglan Street, Mosman.
Foreman, Dr. Joseph.....	141 Macquarie Street, Sydney.
Gannon, Mr. Frederick.....	Tempe.
Gannon, Mr. H. E.....	Harrow Street, Rockdale.
Ghest, Capt. R. C.....	Chiswick.
Gorman, Mr. Henry.....	Strathfield.
Greaves, Mr. W. A. B.....	"Braylesford," Bondi.
Halloran, Mr. Aubrey.....	14 Moore Street, Sydney.
Haynes, Mr. J. W.....	Campbell Street, North Sydney.
Hennessy, Mr. John.....	Shaftesbury Road, Burwood.
Holdsworth, Mr. J. B.....	30 Castlereagh Street, Sydney.
Jamieson, Mr. J. S.....	"Lilydale," Peakhurst.
Jones, Sir Phillip Sydney.....	College Street, Sydney.
Kemp, Mr. J. Edward.....	182 Phillip Street, Sydney.
Levien, Mr. R. H.....	Double Bay.
Maxwell, Mrs. Walter.....	London.
Mills, Mr. J. Y.....	Grosvenor Road, Lindfield.
Moses, The Hon. Henry, M.L.C.....	76 Pitt Street, Sydney.
Nash, Mr. Albert E.....	Chester Street, Woollahra.
Payne, Mr. C. B.....	Birrell Street, Bondi.
Phillips, Mr. Louis.....	"Orwell," Pott's Point.
Ralston, Mr. A. G.....	Wigram Chambers, Phillip Street, Sydney.
Sands, Mr. Robert.....	Carrington Road, Waverley.
Spain, Colonel A.....	16 Spring Street, Sydney.
Suttor, The Hon. Sir Francis B.....	Darling Point.
Todd, Dr. R. H.....	Northfield Chambers, Phillip Street, Sydney.
Watkins, Mr. R. G.....	"Carisbrooke," Botany Street, Waverley.
Wentworth, Mr. F.....	Vaucluse Road, Vaucluse.
Whiting, Mr. W. G.....	Bull's Chambers, Moore Street, Sydney

ANNUAL MEMBERS :

Allen, Mr. A. W.	Australasian Chambers, Martin Place, Sydney.
Archer, Mr. J. M.	Athenæum Club, Castlereagh Street, Sydney.
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BIRD NOTES

By WALTER W. FROGGATT, F.L.S., Government Entomologist.

DURING a recent visit to the Murrumbidgee Irrigation Area near Yanco, while going round with Mr. Houston, I noticed the workmen busy altering the spaces between the wires on the electric lighting standards. On inquiry, he informed me that all this extra work had to be undertaken on account of the Galahs, *Cacatua roseicapilla*, Vieill., having taken to roosting on the wires at nightfall, and when a hundred or more of these Cockatoos plumped down on the wire they weighed it down until it came in contact with the lower wire, and all the lights went out. Birds are occasionally killed by the current.

These Cockatoos frequently collect in immense flocks, and when the Irrigation Area becomes well known to the "bird world beyond" it is very probable that the Galahs will become a serious pest to be dealt with by the farmers growing field crops. The electrical engineer is proposing to fit up and electrify some large dead pine trees where they congregate, if they are likely to become a greater pest than at present.

The Brush Turkey, *Cathelurus lathami*, Lath. In my notes upon this bird, published in the Agricultural Gazette of New South Wales,¹ and reproduced in the Public Instruction Gazette,² I stated that the young chick scratches its way up to the surface of the mound without any assistance from the parent birds. I had not had any personal experience of this mound-builder, but consulted all the best and latest authorities on the matter when writing it up. Gould, one of the first to record his observations on our mound-building Megapodes, who obtained much of his information from the blackfellows he employed, says:—"Some of the natives state that the females are constantly in the neighbourhood of the mound about the time the young are likely to be hatched, and frequently uncover and cover them up again, apparently for the purpose of assisting those that may have appeared; while others have informed me that the eggs are merely deposited, and the young allowed to force their way unassisted."³ Mr. D. Le Souef, Director of the Melbourne Zoological Gardens, who has bred a number in captivity, in several reports states that in every case the young Brush Turkeys made their way up to the surface and escaped from the mound without any assistance. In the "Birds of Australia" the statement is made without any reservation that "The young, when hatched, make their own way out, can fly at once, and lead an independent existence."⁴

During a visit to the Solomon Islands, while stopping at a plantation in the Russell Group, the manager placed some eggs of the Megapode in the kitchen the previous evening, and was surprised on opening the door in the early morning to see a young Megapode fly out and make good his escape into the surrounding scrub.

The following interesting letter received by me from Mr. W. J. Bate, of Homestead Public School, near Tenterfield, New South Wales, should prove of interest as recording actual observations on the habits of the Brush Turkey:—

"As a schoolboy in Lismore I read the story of the 'Brush Turkey' in our Reading Book and, of course, marvelled at the strange method of hatching and at the manner in which the baby birds escaped from the 'incubator.' Turkeys were then very plentiful in the 'Big Scrub,' and, later on, I had a good opportunity of observing them and other birds. But the more I saw of the nests of

1. Froggatt—Agricultural Gazette, N.S. Wales, xxv, Sept., 1914, p. 792.

2. Froggatt—Public Instruction Gazette, (N.S. Wales) Supplement, October, 1914.

3. Gould—Handbook to the Birds of Australia, ii, 1865, p. 152.

4. Lucas & Le Souef—The Birds of Australia, 1911, p. 14.

the Turkey, the more I wondered at the young birds being able to get out of the nest in the manner indicated in the school lesson (exactly the same as now stated by you). I have opened many nests in search of eggs and invariably found them at a depth of over a foot; and the mass forming the nest had always settled down rather compactly; so how a weak chicken could get out without assistance was a continual puzzle. Seeing that the eggs were packed round with the nest material, and a fairly large passage had to be made for its exit, where did the chicken, which, of course, fully occupied the egg space, put the material scratched away? This always beat me. But one morning, during a ramble through the bush, I disturbed a Turkey which had been busily engaged scratching on top of a nest. On reaching the nest I found a hole excavated to a depth of about a foot, and believing that the egg-laying period was over, I looked for another reason for the bird's work. An examination of the hole disclosed a slight movement at the bottom, and, taking a stick, I removed a few leaves, etc., and discovered a baby Turkey, which I took home for a pet. Having made, as I fancied, an interesting discovery, I visited the same nest on several other days, and on each day save one, when I arrived too late, the same thing occurred—the old Turkey was busily engaged in digging out a young one. A curious thing about it was that, on my second visit, the old bird was at work on the opposite side of the nest to where she was on the first day; on the third day she dug for a young one several feet away from the others; then she got one out from just near the first. Each day's chicken came from a different part of the nest.

"That week's experience put an end to my previous doubtful belief in the old story of the young getting out without assistance. I may add that subsequent observations of other nests proved that the old bird always assists her young ones to escape from the nest, and that she knows exactly in which portion of the nest to-day's chicken is waiting to be helped out.

"As regards the activity of the young birds, I have frequently read that they are able to fly almost immediately after emergence. I hardly believe this, because it is usual to find three or four young ones in the vicinity of the nest, and they do not attempt to fly, but rely for safety on running and dodging and on their protective colouring. Young ones are rather difficult to capture by chasing them amongst the bushes and vines."

NOTE.—A further account of the breeding of the Brush Turkey in captivity appears in the Proceedings of the Zoological Society. Mr. A. D. Bartlett there states:—"These birds formed a large mound of leaves, grass, earth, and other materials, in the Zoological Gardens, London, in 1860, during the spring and summer. On the morning of the 26th August a young *Tallegalla* crept out of the mound, and quite regardless of its parents ran about searching for worms and other insects, upon which it fed with as much adroitness and apparent knowledge as the chick of a common fowl would exhibit at a month old."

Mr. Basset Hull informs me that the Solomon Island Megapode (*Megapodius brenchleyi*) does not build a mound, but scratches a hole in the loose volcanic soil, depositing its eggs at a depth of from 18 inches to 2 feet or more. The young bird easily makes its way to the surface without assistance. He obtained some eggs from the natives of New Britain when on a visit to that island in August, 1898. Some of these eggs were wrapped in cotton wool and placed on a spare bunk in his cabin. One of them hatched, and the young bird escaped into the saloon, where it was captured after an exciting chase in which the ship's cat came in second. The bird was then able to fly some distance, although it could not have been hatched many hours. It was placed in a cage and fed on land snails, growing to the size of a Quail in about ten days. On approaching the coast of New South Wales a cold change took place and the bird died.—EDITOR.

TWO BEETLES APPARENTLY NEW TO AUSTRALIA.

By W. J. RAINBOW, F.E.S., Entomologist to the Australian Museum.

(By permission of the Trustees of the Australian Museum.)

As illustrating how insects are introduced into new geographical areas by the agency of commerce, there has just been presented to the Trustees of the Australian Museum a living specimen of an exotic Longicorne, *Eburia quadrimaculata*, Linn. The species was originally described by Linnaeus under the name *Cerambyx quadrimaculata*,¹ the habitat given being America, and it is also described and figured by Spry and Shuckard.² The English habitat is given as "found in Essex," with the remark "doubtlessly imported." Chas. J. Gahan³ describes it under the name "*Eburia binodosa* (Chevr. M.S.)", and the localities there given are Porto Rica, Guadeloupe, and St. Thomas, West Indian Islands. For the benefit of Australian students I quote the following brief description from Spry and Shuckard :

Testaceous, thorax with two black tubercles; elytra with four ivory coloured geminated spots, one at the base, and the second about the middle; eleven lines.

The specimen now in the cabinets of this Museum was presented by Mr. G. Van Henckelum, of Mosman, Sydney, and had worked its way out of an imported oak chair in his home. There can be little doubt that the beetle was present in either its larval or pupal stage when the chair was made, and that its burrow was not observed by the mechanic who worked up the timber. It is impossible, of course, to say how long the creature was in passing through its early stages, but it is well known that many species of *Cerambycidae* take several years in their metamorphosis.

Another importation, also of great economic interest, is a Dermestid, *Attagenus piceus*, Oliv., popularly known in Europe as the "Carpet Beetle." One larva of this species was submitted to me by the manager of one of our large local drapery emporiums, together with samples of woollen materials which it was said to be destroying. Unfortunately that particular larva was dead, but upon a search being made other specimens were found, and from these I was able to breed out the beetle itself. The fully-grown larva of this species is 7 mm. in length, of a bright golden colour, densely pilose, narrow, cylindrical, the abdomen terminating in a long pencil of hairs. The dense pile with which it is clothed imparts to its body a silky, shining appearance. The beetle is just under 3 mm. in length, pitchy black, pubescent, legs and antennae fulvous. In Junk's "Coleopterum Catalogus," Schenkling gives the range of this species as "Paläarktische Region, Nord- und Zentral-amerika." I do not know how long the species is in passing through its various stages from the egg to the adult, because the larvæ were already partially grown when given to me, but one example cast its skin three times, after which it pupated on the 3rd November, and emerged in the adult form on the 14th. Both woollen fabrics in the roll and numerous garments of Jager's clothing had been attacked and rendered unsaleable, and this stock had all been imported from London. Unfortunately, all the examples found were not submitted to me, as the firm's employees ruthlessly destroyed any they met with. It does not follow, of course, from the foregoing that the pest has become established in this part of the world, though the possibilities of its becoming so are apparent, and our importers should be on their guard.

1. Linnaeus—Syst. Nat., 12th ed., 1767, p. 626.

2. Spry and Shuckard—Brit. Coleopt. Delin., Suppl., 1840, p. 75, pl. vii., fig. 2.

3. Gahan—Trans. Ent. Soc. Lond., 1895, p. 95.

THE MIGRATION OF THE JOLLY-TAIL OR EEL-GUDGEON, *GALAXIAS ATTENUATUS*, FROM THE SEA TO FRESH-WATER.

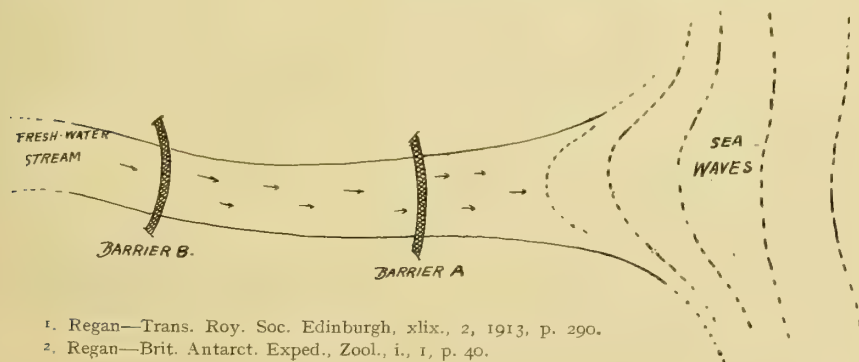
By ALLAN R. McCULLOCH, Zoologist, Australian Museum.

THE occurrence of various species of the genus *Galaxias* in the fresh waters of the several continents and larger islands adjoining the Antarctic oceans has attracted considerable attention. In spite of the fact that several species have been known to breed, or at least to occur, in the sea, it has been argued that such a distribution affords evidence in support of the "Antarctic Continent" theory. Regan, however, has recently expressed the opinion^{1,2} that this evidence is not trustworthy, and the following notes are submitted in support of his contention.

On 31st August, 1913, I obtained a dozen larval *Galaxias attenuatus* from a small stream crossing the beach at Freshwater Bay, near Sydney, at a few yards above where it runs into the sea. The water they were in was quite fresh, but concluding that they were migrating to or from the sea I immediately transferred them to a mixture of half fresh and half salt water; as this treatment did not affect them they were placed in pure sea-water in about fifteen minutes' time. They remained alive and healthy in this for about two hours, though the subsequent handling they received caused the death of all but two specimens. About three hours after their capture these two were again transferred to a freshwater aquarium, in which they have since lived, being now, four months later, alive and healthy.

The stream from which they were obtained is a small one, being about six feet wide and only a few inches deep; in dry seasons it sometimes becomes lost in the sand before reaching the sea, but at the time of our visit was running with a comparatively strong current across the sloping beach. Surf breaks along the whole length of the beach, and at high tide the waves wash some little distance up the stream. A few miles off shore a strong current runs southward during the greater part of the year, carrying small fishes and other pelagic life long distances from the point at which they enter it; this southerly drift has a marked effect on the distribution of marine life on the coast of New South Wales.

Since the surf breaks directly upon the beach, it follows that small fishes migrating from the sea to fresh water must be considerably tossed about in the waves before entering the stream; and when passing upstream they must fight their way against a comparatively strong current before reaching quiet waters. It was, therefore, so surprising to find the delicate larval *Galaxias* in the stream that it was desirable to prove that they really were migrating, and had not merely been washed down by the force of the current. The following test was therefore made with the assistance of several sharp-eyed boys:—



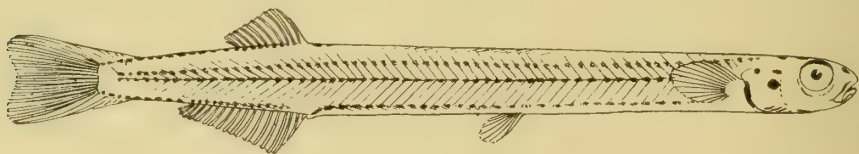
1. Regan—Trans. Roy. Soc. Edinburgh, xlix., 2, 1913, p. 290.

2. Regan—Brit. Antarct. Exped., Zool., i., 1, p. 40.

Two barriers of cheesecloth were fastened across the stream, being placed so that they allowed the water to pass through, but blocked the passage of fish either up or down stream. When first arranged in position both barriers were wholly in fresh water, and a careful search for half an hour failed to discover any fish above, below, or between them; the conditions for searching were particularly good, the water being quite clear and running over white sand, and we could hardly have failed to find the fish had they been present. After half an hour the tide rose sufficiently to send an extra big wave over the lower barrier (*a*) and we immediately afterwards secured a fish above it; successive waves produced further specimens until the lower barrier was destroyed. While we were getting fish at the lower barrier, the upper one (*b*) was also carefully watched, but we failed to find any fish above it; after the lower one was destroyed, however, we found several specimens directly below the barrier (*b*) and swimming stoutly against the strong current of the stream passing through it.

This test was carefully and successfully carried out, and seems to leave no doubt that the fish entered the stream through the surf from the sea, and were making their way upstream. We have, therefore, to assume that they had been bred in the sea, where they had undergone their earlier development; they had possibly been carried far from the place of their birth by the current extending along the coast; and, finally, they must have been remarkably sensitive to the presence of fresh water to discover so small a stream as that in which they were found.

There have been several records of other species of *Galaxias* occurring in the sea, and it appears probable that *G. truttaceus* is not confined to fresh water; it occurs in both Victoria and Tasmania, and I have recently examined specimens from Albany, south-western Australia. Numerous fresh-water animals are common to the northern Tasmanian and Victorian rivers, and are generally supposed to have crossed Bass Strait when that area was elevated above the sea; no such explanation can account for the presence of *G. truttaceus* in south-western Australia, however, and it is more probable that it reached there by way of the sea while in its larval stages.



The following is a description of the larval specimens collected:—

Body cylindrical anteriorly, becoming compressed posteriorly, deepest above the vent. In a specimen 38 mm. long, including the caudal fin, the depth is 11.7 in the total length and 1.5 in the head, which is 7.6 in the length. The dorsal fin begins either slightly in advance of or a little behind the verticle of the anal. Ventrals almost midway between the operculum and the vent. Dorsal with ten, anal with fifteen complete rays, the last being divided in each fin; caudal with sixteen, pectoral with about thirteen rays.

In life the body was quite transparent, with deep black pigment spots scintillating with opalescent colours. They are large and symmetrically disposed on the head, there being one or two on the supero-anterior portion of the snout, and one on each side enclosing the nostrils, another between the eyes, and three on the occiput forming a triangle of which the base is forward; two more behind these coalesce to commence a median series extending along the vertebral column. The lips are black, and there are several larger and smaller spots on the opercles; a broad curved spot on the body below the opercular margin. Eyes black above, iris silver. Vertebral column defined by a row of black spots; one spot marks each vertebra, and I counted sixty-three in two specimens, the last being turned upwards. On each side of the column is another row on the outer surface of the body. A row of spots extends along each side of the alimentary canal in a straight line from the base of the pectoral to the vent. Finally, paired rows of spots are present at the bases of the dorsal and anal fins which extend backward to the base of the caudal. Caudal rays blackish, the others transparent.

Soon after transference to fresh water the larvæ lost their transparency, and rapidly assumed the characters of the adult fish.

Very little has been recorded of the habits of *Galaxias*, but some interesting notes on the occurrence of *G. truttaceus* in damp soil in Tasmania have been made by Messrs. T. S. Hall³ and J. J. Fletcher.⁴ It would seem that this species is capable of burrowing into soft earth to a depth of eight inches, when the water dries up in times of drought, and there æstivating until more favourable conditions supervene. Another species, *G. fudlayi*, is confined to the higher altitudes of the south-eastern part of New South Wales, and occurs almost at the summit of Mount Kosciusko during the warmer months of the year. It apparently migrates during the winter to lower levels, since I searched for it in vain on 2nd October, 1911, at Bett's Camp, about 6,000 feet high, in a stream which was exposed by the melting snow, although Mr. C. Hedley had previously collected it there during the summer. In Digger's Creek, 5,000 feet, however, we saw a few large specimens fighting their way up against the rushing waters: they would dart out into the stream and gain a distance of a foot or so at a time and then retreat to the shelter of the banks for rest.

3. Hall—Vict. Nat., xviii., 1901, p. 65.

4. Fletcher—Proc. Linn. Soc. N.S. Wales, xxxi., 1906, pp. 430, 497, & 566.

FURTHER NOTES ON THE GENUS *TISIPHONE*, HÜBNER.

By G. A. WATERHOUSE, B Sc., B.E., F.E.S.

SINCE my monograph in Part I. of this Journal, I have spent a considerable amount of time in collecting the subspecies of *Tisiphone abeona*, and, assisted by various friends, have accumulated over five hundred specimens from southern Queensland, New South Wales, and Victoria. A detailed study of them must remain over for the present, but the following preliminary results may be of interest, as showing more definitely the limits of some of the subspecies, and also where further information is required. During the spring of 1914 Mr. H. W. Simmonds collected at Bermagui, Tathra and Eden; Mr. S. J. Turner at Kioloa: I worked the coastline from Ulladulla to Coff's Harbour; and Mr. W. Heron continued the investigation northwards to the Clarence River Heads. Many other friends supplied me with specimens, but they have no material bearing on these notes; they will be acknowledged when the full investigation of the genus is undertaken.

Briefly, the specimens show that the subspecies *albifascia* is found in Victoria, and extends along the coast to Bermagui in New South Wales; at Kioloa the white discal band of the hind wing beneath is sufficiently reduced in size for the race to be typical *abeona*, which extends as far north as Newcastle. The Hunter River forms the barrier between *abeona* and the new race *aurelia* described below, which ranges as far north as Camden Haven; then with a maximum range of fifteen miles south of Port Macquarie to twenty miles north of that town, we have the race *joanna*; north of this to Southport, in southern Queensland, the race *morrisi* occurs. No specimens have yet been recorded between Southport and about twenty-five miles north of Brisbane, from where the race *rawnsleyi* is known.

TISIPHONE ABEONA ABEONA Donovan.

Mr. Turner has sent me many specimens from Kioloa, and I caught a good series at Ulladulla, a few miles further north. These are all of the race *abeona*, so the division between *albifascia* and the typical *abeona* occurs between Bermagui and Kioloa. On the north, a series caught by myself near Lake Macquarie were also *abeona*.

Two interesting aberrations of this race are worthy of record. The first was caught by Mr. Simmonds at Stanwell Park, 1000 feet, 22nd November, 1914. It is a male, and has no orange postcellular bar on the forewing above or beneath, and the central orange band is much broader than usual. On the hindwing beneath the white discal band is absent, and the subterminal bands are much broader, but not so well defined as normally. The other specimen is a female from Woodford on the Blue Mountains, 2000 feet, 31st October, 1914. In this specimen the subternal ocellus of the forewing is over twice the usual size.

TISIPHONE ABEONA AURELIA subsp. nov.

Male. Above. Forewing rich dark brown: a broad central area from subcostal at half to tornus, deep orange: a postcellular bar, deep orange: a subapical ocellus and a large subterminal ocellus between vein 2 and vein 3, black centered blue and with whitish pupil. Hindwing rich dark brown: an obscure subapical and a large subternal ringed ocellus, black margined orange red.

Beneath. Forewing dark brown: markings as above but paler, especially postcellular bar: ocelli as above. Hindwing dark brown: a discal band and a double subterminal line, white: ocelli as above.

Female. Above and beneath as in male: bands broader and paler.

Loc.—Port Stephens (*types*), March, October, November, December. Tuncurry, April, May. Coopernook, September, October. Camden Haven, September, October.

This race can be recognised from *abeona* by the deep orange of the bands, the different colour of the margins of the ocelli of the hindwing, and the more prominent markings beneath. Specimens from Port Stephens and Tuncurry show very little variation, and nearly all from Coopernook agree with them, though some few show a trace of an orange discal band on the hindwing above. Most of the specimens from Camden Haven agree with those from further south; a very few show a distinct orange band on the hindwing above, and others have the central orange band reduced in size, especially in the cell: of twenty-five specimens, only two, a male and a female, have paler bands.

I have previously included the few specimens I had in my collection under *joanna*, as they were close to some of that subspecies from Port Macquarie. My long series now shows that the race can be limited as above.

TISIPHONE ABEONA JOANNA *Butler*.

The range of this race, of which no two specimens are exactly alike, is limited to a coastal strip extending a few miles north and south of Port Macquarie. As shown above, the orange banded *aurelia* predominates at Camden Haven, while specimens from Crescent Head, though not quite typical, agree with the race *morrisi*. As no barrier exists between the ranges of these races, it is impossible to draw a definite line separating them, but the limits I have set best suit the facts as at present known.

TISIPHONE ABEONA MORRISI *Waterhouse*.

Specimens from localities between Coff's Harbour and the Clarence River Heads agree with my Richmond River types. South from Coff's Harbour at Bellinger River Heads, Macleay River Heads and Crescent Head, occasional specimens are found with characters tending towards those of the southern race but not sufficiently so to place them outside the race *morrisi*. A specimen from the eastern slope of the Main Divide, caught on a creek running into the Manning River and in about the latitude of Port Macquarie, is of the race *morrisi*. This further strengthens my view that the variable race *joanna* will not be found at any altitude.

In considering the change from the southern broad orange banded *abeona* to the narrow cream banded *morrisi*, it will be noted that it is not gradual, but takes place rather suddenly with the variable race *joanna*. The change from the orange colour to the cream is completed in about fifty miles of coastline, but the influence of pattern is much greater, extending over about one hundred and twenty miles of coastline.

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Edited by
ALLAN R. McCULLOCH,
Zoologist, Australian Museum

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Royal Zoological Society of New South Wales

ESTABLISHED 1879

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The Report of the Council

OF THE

Royal Zoological Society of New South Wales

FOR THE

YEAR ENDED DECEMBER 31st. 1915.

At the Annual General Meeting of the Society, which was held on February 11th, 1915, at the Royal Society's Hall, Sydney, the following retiring Members of the Council were re-elected :—Dr. Sydney Dodd, Dr. Sydney Jamieson, Mr. Allan R. McCulloch, Mr. J. M. Smail, Dr. R. H. Todd, and Mr. G. A. Waterhouse.

At a subsequent special meeting of the Council the following Office-bearers were elected :—President, Colonel A. Spain ; Vice-Presidents, Charles Hedley, A. F. Basset Hull, Albert E. Nash, Dr. R. H. Todd ; Treasurer, W. J. Green.

Attendance of Members of the Council at meetings during 1915. Meetings held :—11 ordinary and 1 special : Major J. S. Brunton, 6 ; Dr. Sydney Dodd, 8 ; Mr. H. E. Finckh, 10 ; Mr. W. W. Froggatt, 10 ; Mr. W. J. Green, 12 ; Mr. Chas. Hedley, 6 ; Mr. A. F. Basset Hull, 12 ; Dr. Sydney Jamieson (on active service, granted leave), 3 ; Mr. A. E. Jaques, 5 ; Mr. T. W. Keele, 8 ; Mr. Allan McCulloch, 7 ; Mr. Albert E. Nash, 4 ; Mr. W. J. Rainbow, 9 ; Mr. J. M. Smail, 5 ; Colonel A. Spain, 12 ; Mr. S. T. D. Symons, 8 ; Dr. R. H. Todd, 3 ; Mr. G. A. Waterhouse, 9 ; *Government Representatives* : The Hon. Fred. Flowers, M.L.C. ; The Hon. H. C. Hoyle, M.L.A. *City Council Representatives* : Alderman W. J. Walker ; Alderman J. H. Laurence.

ATTENDANCES.

The number of visitors to the Gardens during the year under review was as follows :—

Sundays, Adults.....	53,460
„ Children.....	28,792
Week Days, Adults.....	85,426
„ Children.....	41,414
Schools.....	986
Naval and Military.....	1,052
	<u>211,130</u>

showing a decrease of 20,530 as compared with the attendance during 1914. The very adverse conditions caused by the war were largely responsible for the decrease.

ANIMALS.

The collection has been kept well up to standard, many interesting specimens being added. With special assistance from the Government, the Society was enabled to obtain a splendid collection of Antelopes and other animals from Africa, many of which are extremely rare and have not been previously exhibited in Australia. These include Blessbok, Lechee, Impala, Bushbok, Springbok, Duiker, and Sable Antelope. One Brown Hyæna, Black Mangabees, Squirrels, several species of Mongoose, Baboons, Hinged Tortoise, Stanley Cranes, Hornbills, Egyptian and Spur-wing Geese, and several Turaco—the latter are very brilliantly coloured birds and form one of the principal attractions of the large Flight Aviary.

Mr. R. H. Dangar presented a fine herd of Indian Antelope to the Society, and as it includes more than are required for exhibition purposes, it is intended to deposit some of them at the Hotel Kosciusko and other State Institutions.

Among the births during the year, that of a Chacma Baboon, born towards the latter end of December, is the most interesting, and the animal should prove a great attraction when strong enough to be placed on exhibition.

The following is a list of animals and birds born and reared in the Gardens during the year :—

1 Chacma Baboon	1 Antilopine Kangaroo
1 Barbary Sheep	1 Rat Kangaroo
1 Timor Deer	2 Golden Agouti
1 Fallow Deer	2 Bronzewing Pigeons
1 Hog Deer	2 Blood Breasted Pigeons
1 Woodward's Kangaroo	3 Spotted-sided Finches

336 specimens were presented to the Society, and the Council is much indebted to the donors; 76 were placed on deposit for various periods and 46 received in exchange; 423 specimens were sold and 96 sent in exchange, while 59 duplicate specimens were deposited in Taronga Park and other Government Reserves; 2 specimens escaped and 3 were stolen. Several collections of fish were also exchanged. The value of the collection on December 31st was estimated at £4,712 8s. 9d.

A number of Magpies were sent to Fiji to assist the planters in combating the Coconut Beetle.

GENERAL.

In view of the pending completion of Taronga Zoological Park and the transfer of the animals and other assets of the Society to the Park, it was considered necessary to make an alteration in the rules of the Society to formally legalise the transfer, and the following amendments have been sanctioned :—

The omission of Rule 2 and the insertion in lieu thereof of the following Rule :—

2. The objects of the Society shall be :—

(a) The advancement of Zoology by the exhibition of wild, foreign, or other interesting animals in a living state; by the introduction and acclimatization of desirable and suitable species from abroad, and by the diffusion of useful knowledge with respect to the Animal kingdom.

(b) To hand over the whole of such animals or any number of them, with or without consideration to the Taronga Zoological Park Trust, or to any corporation or trust having among its objects the exhibition of animals in a living state.

(c) To sell the property of the Society or any portion thereof, including the animals aforesaid or any of them, to any person for such price as the Council of the Society may deem fit; and to hand over all or any of the property of the Society, with or without consideration, to the Taronga Zoological Park Trust, or any corporation or trust as aforesaid.

(d) To surrender any leases.

(e) To give or lend the whole or any portion of the Funds or other property of the Society to the said Taronga Zoological Park Trust, or any other corporation or Trust as aforesaid.

In consideration of this transfer of property, the Taronga Park Trustees have agreed to allow members of the Society to retain the privileges they now possess at Moore Park, with regard to the new Gardens, under the following agreement :—

In consideration of the transfer of the properties mentioned in the Schedule hereto by the Royal Zoological Society of New South Wales (hereinafter called the Society) to the Trustees of the Taronga Zoological Park (hereinafter called the Trustees) the Trustees hereby grant to the Society :—

- (1) *a.* Free admission to the Taronga Zoological Park to each Member of the Society upon production of his or her card of membership as issued by the Society under its rules.
b. Twenty tickets per annum for admission of adults or children to the Park in respect of each Member of the Society ; provided that the Society shall pay to the Trustees the sum of twenty-one shillings in respect of each Member in excess of two hundred and fifty to whom such free admission and tickets shall be granted.
- (2) Permission to the Society to conduct scientific investigations in Zoology in the Park on such terms and conditions, and subject to such supervision as the Trustees may require, and for that purpose the Society shall be allowed such facilities as the Trustees may approve.
- (3) Suitable premises within the Park for use by the Council or other governing body of the Society for the purpose of holding its meetings, and of storing its books and records, and otherwise of conducting its business.

When the transfer of the collection has been effected, it is proposed to devote the funds of the Society and the energies of its Members to the scientific and practical study of the Australian fauna and introduce exotic animals in captivity. To this end the " Australian Zoologist " will be utilised as a means of recording and disseminating the work and observations of the Members.

The lease of the premises at Moore Park that the Society now holds from the Municipal Council of Sydney, terminates in 1920.

The following addition has also been made to Rule 7 :—

(7*a*) On payment of annual subscription a Member shall receive (in addition to the Member's ticket) 20 tickets available for use during the current year ; each ticket to admit one adult or two children ; children only to be admitted when accompanied by an adult. Tickets must be signed before leaving a Member's possession ; unsigned tickets being invalid.

The preparation of Taronga Zoological Park for the reception of the animals has been energetically proceeded with during the year by the Department of Public Works, and it is hoped that it will be sufficiently forward by April, 1916, to be occupied, though it will take some time longer to complete. The enclosures are well built and designed, and the Park should in all respects be very interesting and attractive.

Equitable Building,
George Street,
Sydney, 12th January, 1916.

THE COUNCIL,
THE ROYAL ZOOLOGICAL SOCIETY OF NEW SOUTH WALES,
MOORE PARK,
SYDNEY.

DEAR SIRs,

We beg to report having completed the Audit of the Books and Vouchers of the Society for the year ended 31st December, 1915, and have certified to the accompanying Statement of Receipts and Disbursements as being in accordance therewith.

With a few exceptions all vouchers have been sighted by us, and the production of those missing is promised in due course.

RECEIPTS.

The Receipts of the Society for the year 1915, as set out in detail on the attached comparative Statement, amounted to.....	£5761 17 8
As compared with the year 1914 of.....	5794 10 5
Showing a decrease of.....	<u>£32 12 9</u>

DISBURSEMENTS.

The Expenditure for the year 1915 totalled.....	£5732 17 10
The Expenditure for the year 1914 totalled.....	6191 5 1
Being a decrease of.....	<u>£458 7 3</u>

During the year 1914 the Disbursements were £396 14s. 8d. in excess of the Receipts, but in 1915 there is a surplus of Receipts over Disbursements amounting to £28 19s. 10d., thereby reducing the net overdraft to £392 13s. 10d. at 31st December, 1915. This improvement in the net result of the year's transactions as compared with that of 1914, is caused by the curtailment of various items of expenditure.

The Royal Zoological Society of New South Wales

STATEMENT OF RECEIPTS AND DISBURSEMENTS FOR THE YEAR ENDED 31ST DECEMBER, 1915.

RECEIPTS.		DISBURSEMENTS.	
1915—Jan. 1—		1915—Jan. 1—	
To BANK BALANCES.		By BANK BALANCE.	
Directors' Trust Account.....	£6 3 10	Overdraft—General Account.....	£529 16 8
Add Amount to be Refunded by Taronga Zoological Park Trust.....	3 8 4	Dec. 31—	
	9 12 2	„ Salaries and Wages. £3256 4 10	
City Bank of Sydney No. 2 Account....	53 12 8	„ Maintenance of Premises.....	202 8 0
	£63 4 10	„ Purchase and Transport of Animals... 127 11 0	
„ Cash on hand.....	23 5 6	„ Maintenance of Animals.....	1614 8 9
„ Petty Cash on hand	21 12 8	„ Advertising.....	267 7 11
	44 18 2	„ Office and Printing Expenses.....	110 14 7
Dec. 31—		„ Incidentals.....	139 1 5
„ Government Grant.. 1249 19 8		„ Bank Interest.....	15 1 4
„ Gate Receipts..... 3447 1 3			5732 17 10
„ Elephant Rides.... 308 13 9		„ BANK BALANCES—	
„ Subscriptions..... 103 9 0		Director's Trust Account.....	1 12 8
„ Sale of Animals.... 106 15 4		Add Amount to be Refunded by Taronga Zoological Park Trust.....	7 5 5
„ Sale of Hides, Skins, etc.....	92 14 5		8 18 1
„ Rents.....	176 0 0	„ Cash on hand.....	27 6 9
„ Fines.....	17 16 9	„ Petty Cash on hand	1 18 11
„ Taronga Zoological Park Trust Refund	250 0 0		29 5 8
„ Sundries.....	7 12 6		
„ Sale of Guides.....	1 15 0		
	5761 17 8		
„ Bank Balance.....	430 17 7		
	£6300 18 3		£6300 18 3

We have examined the Books and Vouchers of the Society for the year ended 31st December, 1915, and certify the above Statement to be in accordance therewith.

(Sgd.) L. S. DRUMMOND & CO.,

Incorporated Accountants.

SYDNEY, 12th January, 1916.

SOME NEW ARANEIDÆ FROM THE COUNTY OF CUMBERLAND.

By W. J. RAINBOW, Entomologist to the Australian Museum.

FIGS. 1, 2, 3, 4.

THE present paper contains descriptions of three species new to science from within the county of Cumberland, New South Wales. These represent three distinct families, viz., Uloboridæ, Theridiidæ and Argiopidæ, and were collected respectively by my colleague, Mr. A. R. McCulloch, and Master Chas. Danvers Power, of Burwood.



Fig 1

Uloborus congregabilis, RAINBOW.
Male.



Fig. 2

Uloborus congregabilis, RAINBOW.
Female.



Fig. 3

Phylarchus splendens, RAINBOW. Female.



Fig. 4

Carepalxis poweri, RAINBOW. Female.

Family ULOBORIDÆ.

This family is a very small one, but it embraces a number of remarkable and interesting species, which for convenience have been divided into four sub-families, three of which occur in Australia. The form described below belongs to the genus *Uloborus*, Latr., and is included in the sub-family Uloborinæ. In his great classic, "Histoire Naturelle des Araignées," Simon defines the range of this genus as follows:—"Europa et Regio mediterranea; Africa; ins. Atlanticæ; Madagascar; Asia centr. merid. et orient.; Malaisia; Papuasie et Oceania; America sept., centr., merid. et antilliana."¹ This is a very wide range, when we consider that only about sixty species are as yet known to science. The genus *Uloborus* has been divided by the distinguished author just quoted into four groups, and it is to the last of these, Group D, the new species belongs.

1. Simon—Hist. Nat. des Araign., i., 1892, pp. 214-215.

Genus *ULOBORUS*, Latr.*ULOBORUS CONGREGABILIS*, sp. nov.

(Figs. 1 and 2.)

Male. Cephalothorax, 1.4 mm. long, 1.1 mm. broad; abdomen, 1.8 mm. long, 1.1 mm. broad (fig. 1).

Cephalothorax.—Ovate, hairy. *Pars cephalica* obtuse, arched, yellowish down the middle, sides dark brown; *ocular area* broader than long; *clypeus*, deep. *Pars thoracica* broad, convex, yellow, but having two sub-lateral curved, longitudinal brown bars; *median fovea* deep; *marginal band* broad, dark brown. *Eyes*.—Arranged in two recurved rows of four each; the two median eyes of the front row are the largest of the entire series; they are seated closely together, are very prominent, and are poised upon the summit of a tubercular eminence; the median eyes of the posterior row are separated from each other by a space equal to about twice their individual diameter, while the lateral eyes of this row are each removed from its median neighbour by a space equal to once their individual diameter; anterior lateral eyes are as large as those of the posterior row. *Legs*.—The first pair are the longest and stoutest; the femur is dark brown with a yellowish annulation, patella dark brown, tibia dark brown with pale yellow annulation, metatarsus and tarsus yellow; all the other legs are, with the exception of their tarsi (which are yellow), dark brown with yellow annulations; each limb is clothed with golden pile, and armed with short, stiff spines; relative lengths: 1, 4, 2, 3. *Palpi*.—Short, dark brown, clothed with yellow pile; *genital bulb* large, complicated, and clothed with long golden hairs or bristles. *Falces*.—Robust, dark brown, hairy. *Maxillæ and Labium*.—Dark brown; normal. *Sternum*.—Elongate, arched, subparallel, dark brown, hairy, attenuated and acuminate posteriorly, and terminating between fourth pair of coxæ. *Abdomen*.—Somewhat cylindrical, highest towards the front, overhanging base of cephalothorax, dark brown with greyish patches; at its highest point there are two tubercles, and at the rear of these, two others. *Spinnerets and cribellum* normal.

Female. Cephalothorax, 1.9 mm. long, 1.3 mm. broad; abdomen, from *petiolus* to posterior angle 2.4 mm., from summit of anterior tubercle to spinnerets 4.5 mm., breadth 2.5 mm. (fig. 2).

Cephalothorax.—Ovate, hairy. *Pars cephalica* obtuse, arched, dark brown; *ocular area* and *clypeus* normal. *Pars thoracica* arched, dark brown; *median fovea* deep; *marginal band* broad, yellow. *Eyes*.—As in *Male*. *Legs*.—With the exception of tarsi (which are yellow), dark brown, with pale yellow annulations; first pair much the longest and strongest; each limb clothed with golden hairs, and armed with short stiff spines; *calamistrum*, normal; relative lengths: 1, 2, 4, 3. *Palpi*.—Short, dark brown, annulated with yellow, hairy. *Falces*.—Dark brown, hairy. *Maxillæ and Labium*.—Dark brown. *Sternum*.—As in *Male*. *Abdomen*.—Gibbous, overhanging base of cephalothorax, dark brown, mottled with grey, and having a rather large, whitish reticulated patch at anterior extremity, a large yellowish spot on each side near the middle (in some examples), and a broad concolorous bar running down the posterior angle towards the spinnerets. At the summit there is a large and prominent tubercular projection, and this is bifurcated at the apex; near the base of this projection there are two small tubercles connected by a distinct ridge. *Epigynum*.—This consists of two small tubercles widely separated from each other; at the summit of each tubercle there is a large elliptical pit; each of these is placed obliquely with its apex directed towards that of its neighbour. *Spinnerets and Cribellum*.—Normal.

Hab.—Parramatta, January 11, 1915.

I am indebted to Mr. McCulloch for an excellent series of this interesting species, examples of which he collected both in the field and in buildings. Considerable variation in colour and scheme of ornamentation is noticeable in both sexes. At first I was inclined to regard this species as *U. variabilis*, Keys. From the latter, however, it differs in size, form of abdomen, and the epigynum.² If the student

2. Keyserling—Die Arach. des. Aust. Suppl., 1887, p. 229, pl. xx., figs. 8, 8a, 8b.

will compare Keyserling's figures and description with those herein given he will easily detect the differences to which I refer. Individuals of *U. congregabilis* found in dwellings select dark recesses for their snares, while those that build in the open are usually found in cool, sheltered situations. Whether in buildings or in the open, the species is always found dwelling together in large or small communities, making a web in common, consisting of intricate reticularian lines and small orbs. The latter have each a white ribbon of hackled silk, known as the *stabilimentum*, running across the centre. Each female who has deposited her ova has her own ova-sac, at the mouth of which she mounts guard. This ova-sac or "cocoon," as it is sometimes termed, is of an irregular bag-like shape, closely woven, contains a large number of eggs, and is always suspended among the irregular or reticularian lines. The orbs are invariably placed horizontally or obliquely. Simon³ has described and figured a species of gregarious *Uloborus*, together with its webs and egg-bags, from Venezuela, whose communal habits are similar to its congener from Parramatta. To his species Simon gave the name of *U. republicanus*. It is interesting to note that those individuals inhabiting buildings are much darker than those living in the field.

Family THERIDIIDÆ.

The species hereunder described I associate with Simon's group, Euryopeæ, and, for the time being at any rate, with that distinguished author's genus *Phylarchus*. Two specimens have been presented to me by Master Charles Danvers Power, and two other examples are in his collection. Hereafter it may be necessary to create for this species a new genus. Generally speaking, the legs of the Theridiidæ are long, slender and tapering; but in the species at present under study they are short and sturdy, and, as in the genus *Euryopsis*, Menge, the fourth pair are slightly the longest. The majority of species included in this family are sedentary, and construct a reticularian web for the capture of prey. *Euryopsis* and *Phylarchus*, on the other hand, do not do so, but belong to what Simon terms "Théridiides marcheurs." Consequently they are ground-rovers, and are usually found lurking under stones.

Genus PHYLARCHUS, Simon.

PHYLARCHUS SPLENDENS, *sp. nov.*

(Fig. 3).

Female. Cephalothorax, 1.7 mm. long, 1.4 mm. broad; abdomen, 4.4 mm. long, 2.6 mm. broad,

Cephalothorax.—Ovate, dark brown, nearly black. *Pars cephalica* strongly arched, somewhat obtuse, thoracic groove distinct; *ocular area* broader than long; *clypeus* deep, fringed with hairs. *Pars thoracica* broad, strongly arched, normal grooves and *median fovea* deep, but somewhat difficult to detect owing to the darkness of the carapace. *Marginal band* broad. *Eyes.*—Eight, arranged in two rows of four each; front row more strongly recurved than the rear; lateral pairs contiguous; posterior row bright and glittering, the median pair exceedingly so; anterior row black; front median pair separated from each other by a space equal to fully once their individual diameter, and from the rear median pair by a similar space; the rear median eyes are separated from each other by a space equal to about three-fourths their individual diameter; lateral eyes, both front and rear, are separated from their median neighbours respectively by a space equal to fully one-and-a-half their individual diameter. *Legs.*—Concolorous with cephalothorax, strong, rather short, tapering, hairy, and armed with short and moderately strong spines; relative lengths: 4, 1, 2, 3. *Palpi.*—Short, similar in colour and armature to legs. *Falces.*—Concolorous with palpi, short, acuminate, arched, hairy; fangs concolorous also. *Maxillæ.*—Concolorous also, short, convex, inclining inwards, moderately hairy. *Labium.*—Concolorous with foregoing, short, broader than long, apex curved. *Sternum.*—Concolorous with labium, broadly cordate, arched, moderately hairy, terminating obtusely between posterior coxæ. *Abdomen.*—Large, overhanging base of cephalothorax, ovate, strongly arched, hairy, dark brown (almost black); superior surface ornamented in front with a recurved, reticulated bright yellow bar, and a broad, concolorous median design which commences well forward and terminates near the spinnerets; within this median band there is a delicate scheme of tracery. *Epigynum.*—A small, strongly arched eminence or tubercle, with two large elliptical pits, one on each side.

3. Simon.—An. de la Soc. Ent. Fr., lx., 1891, p. 12, pls. 3 and 4.

Ova-sac.—Sub-globose, about the size of a pea, loosely woven, transparent, eggs round and of a pinkish tint.

Hab.—Kitty's Creek, near Gladesville, Sydney. Taken from under stones.

Family ARGIOPIDÆ.

Subfamily ARGIOPINÆ.

Genus CAREPALXIS, L. Koch.

Another small, but striking, form is the one described below, and which I name in honour of my young friend, Master C. Danvers Power. The genus is a small one, containing as it does only about fourteen species. *Carepalxis* ranges through Australia, Papua, and Central America. In my "Census of Australian Araneidæ," six species are enumerated, and to these I now add one other.

CAREPALXIS POWERI, *sp. nov.*

(Fig. 4).

Female. Cephalothorax 2 mm. long, 1.6 mm. broad; abdomen, 3.6 mm. long, 3 mm. broad.

Cephalothorax.—Ovate, shining, bilobed, reddish-brown, moderately hairy. *Pars cephalica* strongly arched, obtuse, segmental groove profound; *ocular area* broader than long; *clypeus* strongly curved, deep. *Pars thoracica* strongly arched; *median fovea* profound; *marginal band* broad. *Eyes*.—Distributed over three series of 2, 4, 2 respectively; the median group arranged in pairs and forming a trapezium; each pair of eyes, both median and lateral, close together, the former nearly touching each other, and the latter conjoined; anterior median pair smaller than their posterior neighbours; lateral eyes smallest. *Legs*.—Short, strong, tapering, hairy, armed with short spines, yellow, annulated with reddish-brown; relative lengths: 1, 4, 2, 3. *Palpi*.—Moderately long, similar in colour, clothing and armature to legs. *Falces*.—Yellow, shining, strongly arched, tapering, inner angles fringed with fine hairs. *Maxillæ*.—Dull yellow, short, broad, arched, apices inclined inwards. *Labium*.—Concolorous, short, broad, arched, apex curved. *Sternum*.—Broad, somewhat shield-shaped, posterior extremity acuminate, and terminating between fourth pair of coxæ; surface uneven, hairy; two rather large, though not high, tubercles in front, and two smaller ones on each side, and seated opposite the second and third coxæ respectively; the general colour is dark brown, but the tubercles are pale yellow. *Abdomen*.—Somewhat ovate in outline, overhanging base of cephalothorax, and having towards the summit, but seated laterally, two large mammiliform tubercles; posterior angle deep, retreating; the general colour is yellow, mottled with dark brown. *Epigynum*.—Long, slender, straight.

Hab.—Narrabeen, near Sydney.

NOTES ON COLOUR-VARIATIONS OF OPOSSUMS OF THE GENUS *TRICHOSURUS*.

By A. S. LE SOUEF, Director, Zoological Gardens, Sydney.

THE great variation in the colour and markings of the opossums of the genus *Trichosurus* forwarded to the Zoological Gardens, led me, some years ago, to study them systematically, with a view to determining whether the different forms were confined to definite regions. The following notes are based on the examination of a large series of both specimens and skins, and I have to thank the Curators of the Australian Museum (Sydney), the National Museum (Melbourne), the Adelaide Museum and the West Australian Museum for kind permission to examine skins in their charge. I am also indebted to Mr. H. L. White, of Belltrees, Scone, for forwarding specimens exhibiting colour variation.

COMMON OPOSSUM, *Trichosurus vulpecula*, Kerr.

The typical form is grey on the upper parts, with a few black-tipped hairs showing through the under-fur and whitish under-parts; the muzzle, around the eyes, the chin, and the base of the ears are black; terminal two-thirds of the tail black. The tip of the tail and the posterior distal part of the ears are sometimes white, though both these markings are not necessarily present on the same animal. This form is found in the open forest country throughout Australia, with the exception of the Cape York Peninsula.

The variations noticed are as follow:—

- (a) A more or less rufous colouration ranging from a slight wash on the shoulders to an even brown or bright rufous all over the body, in which case the breast may be of a lighter hue or quite white.
- (b) A black colouration produced by a heavy growth of long black-tipped hair coming through the under-fur.
- (c) A fawn colour ranging from even fawn, through yellowish brown to cream.

As in all marsupials, albinism is fairly common, and albinos generally have white offspring.

Brown specimens are most common in Tasmania, and Mr. Robert Hall states that they are chiefly confined to the moist, heavily timbered districts. Out of 4,000 skins exported from Tasmania in 1914, 20 per cent. were brown. On the mainland a more or less brown colouration is very common, particularly in the drier districts; it is more pronounced in Queensland, especially in the north-east, where the form described as *Trichosurus johnstonii*, Ramsay, was first procured. I have examined the fine series of brown specimens in the Australian Museum, and find great variation, there being intermediate forms from grey-brown to bright rufous with a white breast; it also includes examples with white-tipped tails and ears, as in the grey form. As the teeth do not show any variation, and as brown specimens are found in other parts of Australia, I consider *T. johnstonii* is just a local colour variation of *T. vulpecula*, as has already been recognised by Dr. Ramsay. Fawn-coloured animals have been noted from Central Queensland and at Herberton.

A black race is found in the heavily-timbered country round the Colley district and Yallingup, West Australia. This colour is caused by a pronounced growth of long silky black hair coming through the grey under-fur, which, on the back, may measure three inches in length; the breast is whitish or pure white.

It is interesting to note that the descendants of Tasmanian opossums turned out near Lyttleton, New Zealand, some twenty-five years ago, already show variation from the typical form, in that the black silky hair is much more pronounced; the animals are thus darker and the fur longer and less dense.

Animals from North-West Australia have the hair on the tail scanty towards the tip. Opossums from Deal and Flinders Island have slightly smaller ears in proportion to their size than those from the mainland, but are otherwise similar to *T. vulpecula*, and show the same colour variations.

Variation in size is also noticeable, the largest examples coming from Tasmania, while the size is gradually reduced as the species ranges northwards. Generally speaking, animals found in fairly heavy forest country are large, while those from dry districts are smaller. In support of this it may be noted that specimens from forest lands on the north coast of New South Wales are similar in size and appearance to those from Tasmania, and further resemble them in having smaller ears in proportion to the body.

The following are measurements of specimens from various localities, three being measured in each case:—Tasmania: Body, 46-58 cm.; Flinders Island, Bass Strait: Body, 43-45.3 cm., tail 28-35 cm.; New South Wales: Body, 48-53.5 cm., tail 25.3-28 cm. Western Australia: Body, 35-36.5 cm.; North-western Australia: Body, 32-39 cm., tail 24-28 cm.; North-eastern Queensland: Body, 43-47 cm., tail 36-39 cm.

MOUNTAIN OR SHORT-EARED OPOSSUM, *Trichosurus caninus*, Ogilby.

This animal has a much more restricted range than *T. vulpecula*, being confined to the Great Dividing Range, which extends from Victoria to Queensland.

The typical form is found in heavy forest country on the ranges, and chiefly on the stringy bark timber. It has dense grey fur with a whitish breast. In the British Museum catalogue of Marsupalia and Monotremata, Mr. Oldfield Thomas states that the colour is dark grey or deep umber brown. This is evidently a mistake, for *T. caninus* does not show any brown, though skins of the form here described as *T. caninus nigrans*, after having been in spirits, turn brown.



H. Burrell, photo.

Trichosurus caninus nigrans, sub-sp. nov.

BLACK OPOSSUM, *Trichosurus caninus nigrans*, sub-sp. nov.

In general appearance and size this form is similar to the typical *T. caninus*; its fur is short, fine, silky, and black, sometimes showing a slight admixture of grey hair, particularly on the breast; the ears are short and evenly rounded; irides brown. Skull and teeth as in *T. caninus*. The type is in the Australian Museum.

This well marked sub-species is found in the heavy coastal scrubs in North-eastern New South Wales and Southern Queensland.

CONTENTS OF PART III.

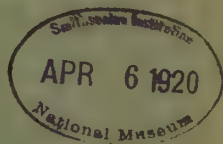
	Page
Report of the Council for 1915.....	53
Some New Araneidæ from the County of Cumberland, by W. J. Rainbow.....	58
Notes on Colour-variations of Opossums of the genus <i>Trichosurus</i> , by A. S. Le Souef	62



THE AUSTRALIAN ZOOLOGIST

Issued by
The Royal Zoological Society of New South Wales

Edited by
ALLAN R. McCULLOCH,
Zoologist, Australian Museum



Vol. 1.—Part 4.

Sydney, 8th October, 1917

SYDNEY:
W. E. SMITH LTD., PRINTERS

Royal Zoological Society of New South Wales

ESTABLISHED 1879

REGISTERED UNDER THE COMPANIES ACT, 1899 (1917)

COUNCIL, 1917.

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Vice-Presidents :

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Hon. Secretary and Treasurer :

G. A. Waterhouse, B.Sc., B.E., F.E.S.



The Report of the Council

OF THE

Royal Zoological Society of New South Wales

FOR THE

YEAR ENDED DECEMBER 31st, 1916.

THE Annual General Meeting of the Society was held on February 9th at the Royal Society's Hall, Sydney. The following retiring members of the Council were re-elected :—Mr. H. E. Finckh, Mr. C. Hedley, Mr. A. F. Basset Hull, Mr. A. E. Jaques, Mr. T. W. Keele, and Mr. W. J. Rainbow. At a subsequent meeting of the Council the following office-bearers were elected :—President, Colonel A. Spain ; Vice-Presidents, Mr. Charles Hedley, Mr. A. F. Basset Hull, Mr. Albert E. Nash, and Dr. R. H. Todd ; Hon. Treasurer, Mr. W. J. Green.

Colonel Spain was granted leave of absence in November, owing to his being called away for active service abroad. Mr. W. J. Rainbow was also granted six months' leave of absence.

Mr. W. J. Green found it necessary to resign his position as Hon. Treasurer in July, owing to ill-health. The Council recorded its high appreciation of his services, rendered to the Society for so many years, and extended to him its good wishes and hopes for a speedy recovery from his indisposition. Mr. G. A. Waterhouse was elected Hon. Treasurer.

Dr. Sydney Jamieson resigned from the Council in September, after having taken an active part in its operations for many years. Mr. J. H. Campbell was elected to the vacancy.

Attendance of members of the Council at meetings during 1916 :—11 meetings held : Major J. S. Brunton, 0 ; Mr. J. H. Campbell (elected in September), 2 ; Dr. Sydney Dodd, 8 ; Mr. H. E. Finckh, 8 ; Mr. W. W. Froggatt, 5 ; Mr. W. J. Green, 2 ; Mr. C. Hedley, 7 ; Mr. A. F. Basset Hull, 9 ; Dr. Sydney Jamieson (resigned September), 1 ; Mr. A. E. Jaques, 6 ; Mr. T. W. Keele, 4 ; Mr. A. R. McCulloch, 8 ; Mr. Albert E. Nash, 4 ; Mr. W. J. Rainbow, 6 ; Mr. J. M. Smail, 3 ; Colonel A. Spain (granted leave of absence), 8 ; Mr. S. T. D. Symons, 7 ; Dr. R. H. Todd, 7 ; Mr. G. A. Waterhouse, 8.

Your Council has to report great changes in the affairs of the Society during 1916. During the first half of the year the Zoological Gardens at Moore Park were maintained and managed by the Council as previously. In anticipation of the projected removal of the collection of animals to Taronga Park only such work as was necessary for the efficient upkeep of the Gardens was carried out. The Director, Mr. A. S. Le Souef, spent much of his time at the new site in general supervision of the construction of the cages, etc., while all the energies of the Council were directed towards the furtherance of the new Zoo.

At a Special General Meeting of the Society, held at the conclusion of the Annual Meeting, February 9th, 1916, a resolution was passed altering the rules of the Society as follows :—

Rule 7 to read :—

Ordinary members shall have the right to be present and to vote at all meetings of the Society ; to propose candidates for admission as members ; and, subject to these rules, to have access to the Library and other establishments of the Society and to Taronga Park.

On payment of the annual subscription, a member shall receive (in addition to the member's ticket) twenty (20) tickets available for use during the current year, each ticket to admit an adult, or two children, children only to be admitted when accompanied by an adult. Tickets must be signed before leaving a member's possession, unsigned tickets being invalid.

A Special General Meeting of the Society was held on 9th February, 1916, to authorise an alteration of the rules, as detailed in the Annual Report for 1915, p. 54, to enable the Council to hand over to the Taronga Park Trust various properties of the Society. Arrangements were also made with the City Council with regard to the removal of various buildings erected in the Gardens at Moore Park, in order that some of the newer cages, etc., might be transferred to Taronga Park.

The preparations at Taronga Park having reached a stage at which the enclosures were ready to receive the animals, it was decided in June to wind up the business of the Society at Moore Park at the end of that month. The Chief Secretary was therefore written to asking that the Government should take over the control of the Zoological Gardens and its responsibilities as from 1st July, 1916.

This being sanctioned, a draft agreement with the Taronga Zoological Park Trust was prepared and forwarded to the Minister for Lands for approval. The terms of this agreement are set out on pp. 54-55 of the Annual Report for 1915. It was hoped that this agreement would have been signed at an early date, but owing to unforeseen legal difficulties arising the matter has had to remain in abeyance. Under these circumstances, such privileges as the Society enjoys with regard to the Taronga Park Zoo are wholly dependent upon the goodwill of the Trustees. On the other hand, there is reason to believe that the interests of the Society are not being overlooked, and plans of a building for our use in the Park grounds have been exhibited to your Council.

The Council decided to retain correspondence and papers relating to the Society, minute-books and records, Library books and office furniture, and asked that half the subscriptions of members for the current year, together with an amount representing half the subscriptions received from life members, be placed to its credit by the Trust. It was decided to open an account in the name of the Society in the Government Savings Bank.

The July meeting of the Council being its last official meeting as Manager of the Zoological Gardens, it was decided that a circular letter be forwarded to the Council's employees, thanking them for their loyal services during the Society's regime. The Director read a short account tracing the career of the Zoo from the year 1865, when it consisted of several animals kept by Mr. William Beaumont at Sir Joseph Banks' Pleasure Grounds at Botany.

" The inception of the present Society was due to the late Mr. Walter Bradley and the late Mr. Harry P. Mostyn, who sent out a notice from 170 Pitt Street calling a meeting for March 24, 1879, ' For the purpose of forming a Society for the acclimatisation of song-birds and useful game.' Four hundred members were enrolled and a sum of £500 collected, to which the Government added a like sum. A number of game and other birds were purchased and liberated in the State, including pheasants, California quail, skylarks, goldfinches, yellow hammers, blackbirds, linnets, bullfinches, horned owls and Chinese quails. The most important move was the importation of 5,000 brown trout ova from New Zealand. These were hatched at Coorwull and liberated near Bega.

" In 1881 a bill drawn up by Mr. F. Gannon for the protection of wild and native game was passed. By permission of the City Council the Society formed a depot at Billy Goat Swamp, Moore Park, the site of the late Gardens, and aviaries and a caretaker's cottage were built for the care of the wild birds that were being collected for acclimatisation purposes.

" In 1880 the late Mr. G. F. Want gave permission for the Society to use his office, 40 Hunter Street, and the following Committee was appointed to manage its affairs:—President, Arthur Todd Holroyd; Committee—Charles Moore, F. Gannon, G. Want, H. Mostyn, Hon. Charles Moore, Yeo, William Beaumont, George Bennett, Dr. Dansey, Walter Hall, Walter Bradley. In 1881 it was decided to lay out the grounds as a Zoological Gardens. This was completed in 1883, and Dr. George Bennett was elected President of the Society. A sum of £352 was collected by subscription for the purchase of two elephants, which arrived in the Gardens at the end of 1883. It is interesting to note that one of them, Jessy, is still to the fore, having been a delight to tens of thousands of children during her thirty-three years in the Gardens.

" The chief energies of the Society were still directed to the acclimatisation of fish, and thousands of trout ova were imported from New Zealand and Tasmania and put into the southern streams, and many English perch distributed into rivers and ponds to the north and west. In looking back to these activities, stress must be laid on the success of the acclimatisation of trout in the State. This business soon became so important that it was taken over by the Fisheries Department, which has continued the work very successfully.

" The Gardens were opened to the public in 1884, and in that year the receipts from the gates were £899. In the following year this had risen to £2,700 6s. 8d. School children had been admitted free, and in that year 36,062 attended. In 1884 Sir John Robertson and Robert Lucas Tooth were Vice-Presidents. In 1887 Sir Henry Parkes was President, and John Keep Treasurer. In 1889 George Edward Rundle was President. In 1903 Mr. Catlett, who was Secretary from the inception, died. He (Mr. Le Souef) succeeded to the position, and Mr. W. A. B. Greaves was appointed Treasurer.

" In 1906 Sir Thomas Anderson Stuart was President, and Dr. Todd Treasurer. In 1910 Captain Ghest was President, and shortly after Mr. Charles Hedley was elected to the position. In 1912 Colonel Spain was appointed President, and Mr. Green Treasurer.

" In 1902-3, owing to drought and financial depression, the funds of the Society got low, but from this time on, with careful management, the Council had been able to record marked progress—so much so, that in 1910 it was realised that the site at Moore Park had either to be enlarged or another position found to which the whole collection could be removed and housed on up-to-date lines. The City Council having refused any more of Moore Park, various localities were inspected, including Harris Park, Maroubra, Upper Lane Cove, Pearl Bay, Vacluse, Bondi, and Queen's Park. The Council finally decided to ask for 50 acres at Ashton Park, which was granted by the Government. Work at this new site was commenced in 1912, and now, in 1916, largely through the efforts of Mr. Fred. Flowers and Mr. H. C. Hoyle, the undertaking is being brought to a conclusion.

" During the last thirty-three years the Government has granted to the Society the sum of £60,158 for the maintenance of the gardens; members have subscribed £4,870, and, approximately, £80,000 have been received from other sources. About 7,500,000 visitors have entered the grounds, a considerable proportion of whom have been admitted either free or at a nominal rate on Sundays. The State school children have always had the free run of the grounds for the purposes of studying the animals and recreation."

(Signed) ROBERT H. TODD,

CHAIRMAN.

The Royal Zoological Society of New South Wales.

STATEMENT OF RECEIPTS AND DISBURSEMENTS FOR THE HALF-YEAR ENDED 30TH JUNE, 1916.

RECEIPTS.				DISBURSEMENTS.			
1916—Jan. 1—				1916—Jan. 1—			
To BANK BALANCES.				By BANK BALANCE.			
Directors' Trust Account..	£1	12	8	Overdraft—General Account		£430	17 7
Add Amount to be Re-				June 30—			
funded by Taronga Zoo-				By Salaries and Wages.....	£1580	9	0
logical Park Trust.....	7	5	5	" Maintenance of Premises..		99	8 3
			8 18 1	" Purchase and Transport of			
" CASH ON HAND.....	27	6	9	Animals	456	5	8
" PETTY CASH ON HAND....	1	18	11	" Maintenance of Animals..	582	11	7
			29 5 8	" Advertising.....	164	16	7
June 30—				" Office and Printing Ex-			
To Government Grant.....	1200	0	0	penses.....	78	13	10
" Gate Receipts.....	1531	13	5	" Incidentals.....	83	2	11
" Elephant Rides.....	146	15	0	" Bank Interest.....	3	4	3
" Subscriptions.....	89	5	0				3048 12 1
" Sale of Animals.....	90	17	10	" BANK BALANCES.			
" Sale of Hides.....	56	0	7	Directors' Trust Account	1	13	8
" Rents.....	92	0	0	Add Amount to be Re-			
" Fines.....	14	5	0	funded by Taronga Zoo-			
" Sundries.....	1	5	9	logical Park Trust....	4	0	0
" Sale of Guides.....	0	10	6				5 13 8
			3222 13 1	" CASH ON HAND.....	50	18	1
" BANK BALANCE.				" PETTY CASH ON HAND...	42	1	4
Overdraft—General Account			317 5 11				92 19 5
			<u>£3578 2 9</u>				<u>£3578 2 9</u>

We have examined the Books and Vouchers of the Society for the half-year ended 30th June, 1916, and certify the above Statement to be in accordance therewith.

(Signed) L. S. DRUMMOND & CO.,
Incorporated Accountants.

SYDNEY, 2nd August, 1916.

STATEMENT OF RECEIPTS AND DISBURSEMENTS FROM THE 1ST JULY TO THE 31ST DECEMBER, 1916.

DR.				CR.			
To Subscriptions.....	£14	14	0	By Bank Balance—			
" Fines.....	6	12	2	Savings Bank of N.S.W.	£21	6	2
			<u>£21 6 2</u>				<u>£21 6 2</u>

(Sgd.) G. A. WATERHOUSE, Hon. Treas.

We have examined the Accounts of the Society for the six months ended 31st December, 1916, and certify the above Statement to be in accordance therewith.

(Sgd.) L. S. DRUMMOND & CO.,
Incorporated Accountants.

SYDNEY, 8th February, 1917.

THE Royal Zoological Society of New South Wales.

ITS PRESENT POSITION AND FUTURE AIMS.

By A. F. BASSET HULL, President.

IN pursuance of the powers vested in the Council of the Society by the Members at the Special General Meeting held on 10th January, 1916, the Society's collection of animals and birds, together with all cages, buildings and apparatus contained in the Zoological Gardens at Moore Park, were handed over to the Trustees of Taronga Zoological Park. The transfer was formally made by resolution of the Council passed at a meeting held in the office in the Moore Park Gardens thenceforward to be known as "the old Zoo"—on 13th July, 1916. Some birds and animals had already been taken to the "new Zoo" at Taronga Park, and the remainder have since been transferred to the more spacious grounds on the northern shore of the Harbour.

The Society retained its library and office furniture, and claimed to be entitled to certain moneys representing members' subscriptions for the unexpired half of 1916, and the balance (£750) of a sum of £1,000 advanced to the Taronga Park Trust in 1912 for preliminary work in connection with the new site.

Owing to the fact that the Trustees of Taronga Park were also members of Council of the Society, and the Society's Director was the Trustees' Secretary, matters financial were conducted under an informal arrangement which rendered any strict accountancy quite out of the question. The balance sheet presented at the Society's Annual Meeting showed that an overdraft of £317 remained unpaid, and that there was about £93 cash in hand. The Trust subsequently paid the overdraft. One-half of the subscriptions paid by members for 1916, together with one-half of life members' subscriptions, amounted to £135, and the balance of the advance, after adjustment of the overdraft and cash in hand, was £526, a total of £661 claimed by the Society.

Unforeseen difficulties arose in regard to the legal position of the Trustees as to these moneys, and, after some correspondence, a conference was arranged at which an executive committee of the Council discussed the position with the Chairman of the Trust, and it was eventually arranged that the Council should waive all claim to the moneys in question, the Trust increasing the number of members of the Society to whom free entry to Taronga Park is granted, from 250 to 300. The terms of the amended agreement were drawn up and formally assented to, as follows:—

- (a) The number of members of the Society to whom free admission to the Park and 20 tickets per annum is granted to be increased from 250 to 300.
- (b) Permission to conduct scientific investigations in the Park subject to supervision to remain as already agreed upon.
- (c) Pending the erection of permanent suitable premises in the Park for the holding of the Society's meetings and storage of its records, as a temporary arrangement the Society to have the use, when required, of the large room over the refreshment room, and a convenient place within which the Society's library and records can be securely kept, access to same to be permitted only to the Council of the Society and the Trust or its responsible officers.
- (d) The Council to have the use of its furniture and other effects, now on the premises of the Trust.
- (e) The Council to relinquish any claim to payment in cash in respect of subscriptions for ordinary or life members up to 31st December, 1916, or the sum of £1,000 advanced by the Society to the Trust, or any balance thereof.

In accepting these terms the Council was actuated by an earnest desire to assist in every way possible in the achievement of the object towards which its endeavours had been directed during the past six years, viz., the establishment of Zoological Gardens worthy of the great City of Sydney. While the conditions under which the Government rendered the present magnificent site available for the purpose precluded the Society from retaining its supervision and management, the Council nevertheless felt bound to place the main object in a paramount position, and to exercise the powers vested in them by the Society to that end. The Trustees have asked for the co-operation of the Council and the assistance of those with special knowledge of zoological matters, and such support will be most heartily accorded.

That the ultimate result has been to establish a harmonious agreement under which the Society and the Trustees will work together to ensure the building up of the finest Zoological Park in the southern hemisphere must be regarded as in the highest degree satisfactory.

The Council then proceeded to carry out a project which had been under consideration for some time—the incorporation of the Society as an association not carrying on business for profit. The Memorandum and Articles of Association were drawn up, and adopted by resolution at a Special General Meeting held on the 30th June, 1917, in the already famous Zoological Gardens at Taronga Park. After confirmation of the resolution at a subsequent meeting held on the 19th July, the Society was duly registered under the Companies Act, 1899.

Starting with £120 to its credit, and with a potential income of about £300 per annum from ordinary members' subscriptions, the Society can now enter upon its new and wider field of usefulness. The limited objects of the old Society have been expanded, and the Memorandum of Association now covers the following extensive range of subjects :—

- (a) To promote and advance the Science of Zoology.
- (b) To protect preserve and study the indigenous and introduced animals of Australia.
- (c) To introduce and acclimatise desirable and suitable animals from abroad.
- (d) To establish equip and maintain or assist in the establishment equipment and maintenance of biological stations in suitable localities within the State of New South Wales for the purpose of investigation observation and record of the life histories of the indigenous Fauna.
- (e) To promote hold and/or convene any congress of societies or individuals for the purpose of discussing zoological subjects and of taking such action in relation to Zoology as may be determined upon at any such congress.
- (f) To care for maintain treat and observe wild animals in captivity or otherwise.
- (g) To join with any other Society either within or outside of Australia in promoting the study of Zoology in all its branches.
- (h) To provide and maintain such premises libraries museums scientific collections laboratories and other scientific accessories and conveniences as may be deemed necessary or requisite for the information entertainment demonstration education convenience and use of the members of the Society.
- (i) To furnish and equip all and every such premises libraries museums laboratories accessories and conveniences.
- (j) To take over the assets and liabilities of any Society or Corporation having objects wholly or in part similar to the Society and in particular of the unincorporated Society known as the Royal Zoological Society of New South Wales.
- (k) To print publish and distribute or cause to be printed published and distributed any magazines pamphlets periodicals books or leaflets which the Society may think desirable for the diffusion of useful knowledge with respect to the animal kingdom and for the promotion and achievement of its objects.
- (l) Subject to the provisions of the Companies Act, 1899, section 53 to purchase take on lease (including building or improving lease) or in exchange hire or otherwise acquire any real and personal estate which may be necessary or convenient for any of the purposes of the Society.
- (m) To construct maintain demolish repair renew replace and alter any houses improvements buildings fixtures fittings or works necessary or convenient for the purposes of the Society.

- n)* To take or accept any gift whether subject to any special trust or not for all or any of the objects of the Society.
- (o)* To sell manage lease mortgage dispose of or otherwise deal with all or any part of the property of the Society.
- (p)* To borrow and raise money in such manner as the Society may think fit.
- (q)* To invest any moneys of the Society not immediately required for any of its objects in such manner as may from time to time be determined.
- (r)* To promote establish subsidise and support and to aid in the promotion establishment and support of any branch or affiliated associations and to inaugurate and carry out any scheme or system of affiliation.
- (s)* To promote the passing of or enforcing or to join with any other Society or any body or persons in having passed or enforced any legislation having for its object the preservation or protection of the Fauna of New South Wales or elsewhere in Australia or any other object in connection with Zoology.
- (t)* To offer give or contribute towards any scholarship prize medal or award for any research literary contribution article essay or effort connected with Zoology or any kindred or interdependent study.
- (u)* To apply the profits (if any) or other income of the Society for the promoting of the above objects.
- (v)* To do all such other lawful things as are incidental or conducive to the attainment of the above objects.

The incorporation of a Society having these objects provides the machinery, and two essentials are required to make the machinery run smoothly and successfully—labour and lubricant—which in this case mean members and money. As regards the first, the Society's membership roll now contains the names of many of the leading zoologists of New South Wales, and it is confidently anticipated that eventually every resident in this State interested in the study and care of animals will become a member. Although the Society's funds will not benefit from the subscriptions of ordinary members exceeding the 300 agreed upon, every subscription in excess of that number will add to the income of the Taronga Zoological Park, and will thus aid in furthering one of the Society's objects.

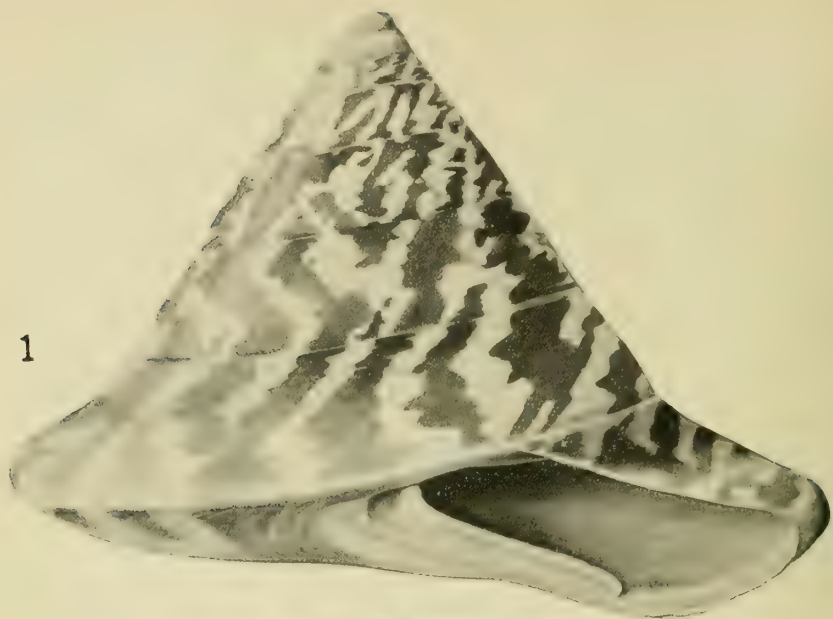
The Society's funds will be augmented by the full amount of the subscriptions paid by associate members. This class was established with a view to enlisting the interest of country residents, who cannot take advantage of the right of entry to the Park, residents of other States and foreign countries. To the amount received from this source will be added such special donations as members and the general public may think fit to contribute. Similar societies in other parts of the world depend largely upon such benefactions for the carrying out of their objects, and there is no reason why New South Wales should not be able to liberally endow its own Society. To cite some instances, the American Museum of Natural History, New York, has a permanent endowment fund exceeding a quarter of a million sterling contributed by wealthy American citizens, and an annual income of several thousand pounds from members' subscriptions; the Smithsonian Institution is also largely supported by donations, its permanent fund standing at £205,000, and its income being £22,000 for the year 1915. In addition to this, the Institution disbursed £136,000 of Government grants for scientific purposes during that year, including £20,000 on the maintenance and improvement of the splendid Zoological Park at Washington, which embraces an area of 268 acres.

As the Society grows and enters upon its more important objects, particularly the publication of useful information and the establishment of biological stations for the study of the different faunal groups of the Australian regions, it also may reasonably look to the Government of the State for assistance in these directions.

Such objects, carried out in a careful and systematic manner, should be of great value both from a scientific and an economic standpoint, and render appreciable aid to University and research students by providing them with material for study and facilities for its examination.

It remains only to impress upon all members the value of personal effort directed towards increasing the Society's membership and inducing those who are able to do so to contribute to a Permanent Endowment Fund.

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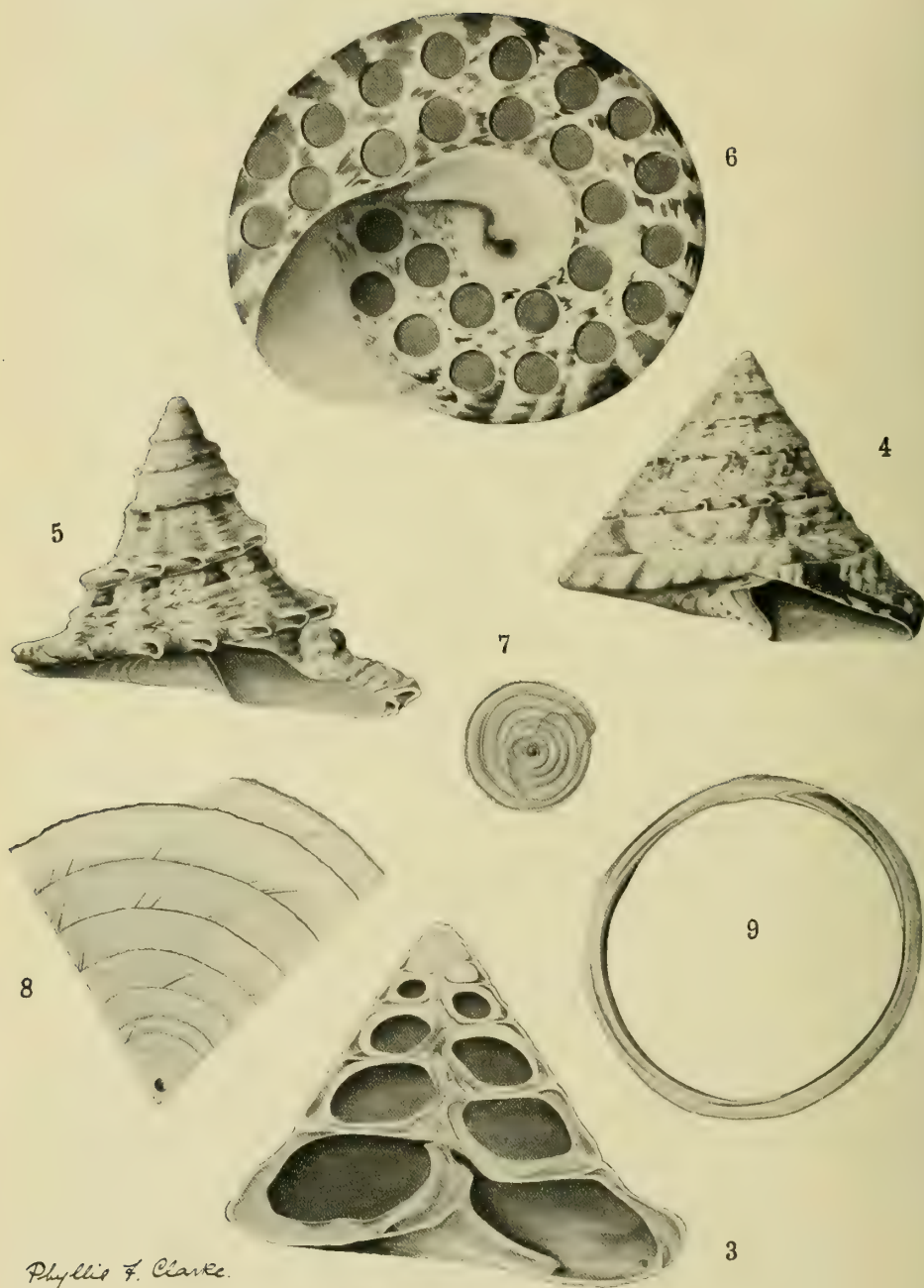


2



Phyllis F. Clarke

Trochus niloticus.



Phyllis F. Clarke.

Trochus niloticus.

THE ECONOMICS OF *TROCHUS NILOTICUS*.

By CHARLES HEDLEY.

(Plates v.-vi.)

The following was written as a Report from the Special Committee on Marine Biological Economics of Tropical Australia, appointed by the Commonwealth Institute of Science and Industry.

NOMENCLATURE.

THIS large and handsome shell was mistaken for a product of the River Nile by Aldrovandus, who, in 1606, was the first writer in Europe to describe it. Thus Linnæus in 1767 adopted from him the title of *Trochus niloticus*. Other scientific names that it has since received are *Trochus spinosus* Gmelin, 1791; *Trochus flammeus* Bolten, 1798; *Trochus zebra* Perry, 1811 (Mathews & Iredale, Victorian Naturalist, xxix., 1912, p. 13); *Trochus marmoratus* Lamarck, 1822; *Astratium pagodus* Wood, 1879 (Hedley, Proc. Linn. Soc. N.S. Wales, xxxiii., 1908, p. 467); and *Trochus montebelloensis* Preston, 1914. In the Philippine Islands it is popularly known as "Chin leh," and at Cape Bedford, Queensland, the aborigines call it "Dobbi."

Trochus niloticus had long been considered (Lamarck, Syst. An. s. vert., 1801, p. 85) as the type of the genus *Trochus*. But Iredale (Proc. Malac. Soc. x., 1912, p. 225) notes that not being one of the original party, it is inadmissible, and designates *T. maculatus* as the type. As a sectional name *Pyramidea*, Swainson, may be appropriated by *T. niloticus*.

DESCRIPTION OF THE SHELL.

The remarkable feature of *T. niloticus* is the grotesque expansion of the last whorl. In the related *T. maximus*, not yet recorded from the South-west Pacific, the normal angle of the spire is continued as usual to the last. But in *T. niloticus* a bulge commences in the penultimate whorl, and increases rapidly, carrying the last whorl out of alignment with the rest. So that the last whorl approaches the horizontal, and the aperture, from being twice as broad as high, becomes three times as broad as high. Finally the insertion of the lip tends to drop below the periphery.

As with other large species, the summit is so severely eroded that the upper whorls cannot be counted on any adult individual. By combining measurements of a young, of a half grown, and of a large shell, I arrived, as follows, at an estimate of fourteen whorls for a complete specimen. In the youngest example used, having a maximum diameter of fifteen millimetres, the earliest, or at least one whorl, had already vanished. The presumed second whorl is 1 millimetre in diameter, the third $1\frac{1}{2}$; the fourth 2; the fifth 4; the sixth 5; the seventh $7\frac{1}{2}$; the eighth 12 mm. Now changing to the medium shell, that whorl which has a diameter of 12 mm. is presumed to be the eighth; accordingly in this individual the seventh whorl is 8 mm.; the eighth 12; the ninth 19; and the tenth 30. Again changing to the largest shell, that whorl which has a diameter of 30 is regarded as the tenth, and thus proceeding, the ninth whorl has here a diameter of 20; the tenth 30; the eleventh 42; the twelfth 64; the thirteenth 91; and the last and fourteenth 142 mm. (say $5\frac{1}{2}$ inches). The minor diameter of this measured shell (Figs. 1, 2) from Samarai, Papua, is 123 mm., the height 120 mm.; the weight is a pound and a half. No such size has, so far as I am aware, been recorded in literature. Fischer (Monogr. Trochus, 1880, p. 67), gives the breadth as 140 mm., the height as 95 mm. The largest specimen which von Martens had examined was only 124 mm. in breadth; this he contrasted with a dwarf only 61 mm. high and 67 broad (Martens, Ann. Mag. Nat. Hist. (3) xx. 1867, p. 99). Other Samarai shells have a diameter of 141, 137, 135, and 129 mm., and another from Torres Strait is 133 mm. The correspondent, to whose kindness I owe this material, writes of giants from Samarai of eight inches diameter, which he has seen. Such would probably have an additional half whorl.

Nothing definite is known of the age of *T. niloticus*. According to native tradition in Fiji, the mollusc lives for four years; the youngest stages are passed in deep water on the reefs, a shell at two inches diameter is thought to be six months old, at three inches one year, and at four inches two years, the rate of increase becoming slower as growth proceeds.

The upper and lower whorls are diversely sculptured. For the first eight whorls, in the *pagodus* stage (Fig. 5) the periphery carries projecting, imbricating, hollow, arched scales at about 1.4 to a whorl. A transition stage, that of *spinus* (fig. 4) follows, in which, for a whorl or two these scales are gradually modified into obliquely compressed tubercles and then vanish, leaving the peripheral keel quite smooth. In this family, such scales are a usual feature, reaching especial development in *Astrea heliotropium*, *Guildfordia triumphans*, *Angaria delphinula* and *Turbo marmoratus*. Even when lost in maturity, these tend, as here, to appear in infancy. They also do so in the case of *Turbo stamineus* (Kesteven, Proc. Linn. Soc. N.S.W., xxvi., 1902, p. 175, Pl. xxxv., f. 2). It is now suggested that these peripheral scales may be a reminiscence of the pore-scales of *Halotis*. In respect of these scales *T. niloticus* is further developed than such co-generic types as *T. nodiferus* and *T. dentatus* where the scales persist throughout life. On the upper whorls the area between the peripheral scales and the channelled suture is occupied by four or five spaced lyrae, the two upper nodulous, the others flat. On succeeding whorls the lyrae first multiply and then disappear gradually. At eight whorls the base has about fourteen fine, spiral, lyrae, increasing by intercalation and as broad as their interstices. These continue of the same relative importance to the eleventh whorl, after which they gradually fade till scarcely a trace can be distinguished on adult shells.

The axis is a cork-screw shaped columella, the last turn of which is free in the axial funnel, the remainder embedded in the roof of callus above. Below this plait the columella is produced in a longer spiral to a broad, horizontal, knife-like process at the base of the aperture. In young shells the false umbilicus is a narrow, deep, spiral funnel with steep sides, but in senile examples the hollow is filled with a callus pad, nearly flush with the rest of the base. The centre and columella are nacreous, a crescent opposite the aperture is porcellaneous. A similar succession is seen in the inner lip, where the border is porcellaneous and the interior is nacreous. When the shell has been boiled, the fact is shown by superficial, microscopic cracks in the nacre of the axis. The right and left insertions of the lip leave between them an uncovered space of the previous whorl. Only the last four whorls of the adult shell are inhabited, the earlier ones being filled solid with porcellaneous callus. (Fig. 3).

The colour is a white ground painted with zic-zac red flames as broad or broader than their interstices and descending forwards across the line of growth, and ranging from light pink to dark purple. On the base these flames sometimes break up into cuneiform marks with the points directed backwards. Within the aperture red is often replaced by olive-green, but this is not, as von Martens supposed, a result of the original colour fading. On the upper whorls are a subsutural row of six or seven purple patches, between which are close, narrow, rose-pink lines sometimes appearing on the lyrae as articulations or arrow heads.

In life, the whole shell, except the axial area, is clad in a fibrous epidermis, brittle when dry, frilled into small lamellae set at four to the millimetre. These run down backwards, along the lines of growth but across those of colour. This epidermis does not intrude into the axial funnel.

The operculum (fig. 7) is a thin, flat, round, chitinous plate, 32 mm. in diameter, composed of numerous narrow spirals. Below, it is glazed with chitin deposited after the growth of the spirals and showing a line of muscular attachment. In the centre is a minute pivot knob, on which the whole operculum revolves. On the upper surface is a small, corresponding axial pit. These features seem not to have been previously observed.

The upper side is in life probably raised in a low cone, for the middle is abraded. For this reason it is impossible to count the whorls which obviously exceed ten. Probably the operculum corresponds whorl for whorl with the shell, thus making fourteen. On the outer spiral is a dark border and a fringe along which a subsequent spiral would be wound.

The animal was illustrated by Quoy and Gaimard (Voy. Astrolabe, Pl. 62, fig. 12). It is curious that no epipodial filaments are shown by them. The left cervical epipodium is shown unsplit, as it appears in a smoke-dried specimen before me. The radula was figured by Troschel (Das Gebiss der Schnecken, ii., 1879, p. 224, pl. xxi, fig. 11, a-d).

On what kind of sea-weed the *Trochus* feeds, what eggs it lays and where, as well as most details of its life-history are unknown.

Though the sexes are separate, there is no distinction between the shell of a male and of a female animal. The reproduction of the species was studied in New Caledonia by Mr. Montague (P. D. Montague, Revue Agricole de la Nouvelle Calédonie, No. 45, 1915, pp. 39-43, plate I.), who unfortunately was unable to continue his researches throughout the year. In shells of a diameter of from 10 to 12 cm. ($4\frac{1}{2}$ inches) he found the ripe sexual glands to extend over almost all the liver, at the summit of the coil, grey in colour in the male and dark green in the female. At the end of December the ovaries of several specimens, 9 cm. in diameter, were distended with eggs ready for deposition. A series of specimens ranging from 7 to 8.5 cm., examined in October and May, showed the sexual glands to be small and undeveloped.

Mr. Montague concluded, firstly, that the eggs were laid early in the year; secondly that the animals of shells less than 8.5 cm. ($3\frac{1}{2}$ inches) are incapable of reproduction. The latter conclusion is, however, only tentative.

GEOGRAPHICAL RANGE.

The real home of this mollusc is not, as early writers supposed, in any river, but on coral reefs. It ranges from Ceylon (Hanley in Tennent, Ceylon, i., 1859, p. 241) in the west, to Samoa (Schmeltz, Mus. Godeffroy, Cat. iv., 1869, p. 101) in the east, and to the Loo Choo Islands (Pilsbry, Cat. Mar. Moll. Japan, 1895, p. 179) in the north. In Australia it was recorded by Brazier from Torres Strait and by Tenison Woods from Port Douglas (Proc. Linn. Soc. N.S.W. ii., 1878, p. 42 and v., 1880, p. 116). From the Monte Bello Islands in Western Australia it has apparently been described as *Trochus monte belloensis* (Preston, Proc. Malac. Soc., xi., 1914, p. 16, fig.). For food it was used by the New Caledonians (Fischer, Journ. de Conch. vii., 1859, p. 331), by the islanders of Torres Strait (Jukes, Voy. Fly, i., 1847, p. 178), and by the natives of Cape Bedford, Queensland (Roth, North Q'land Ethnogr. Bull. iii., 1901, p. 19). The periphery of the shell was cut out, smoothed and worn as a bracelet by the Papuans (Edge-Partington, Ethnographic Album, First series, part 2, 1890, Pl. 289, fig. 5; Pl. 290, fig. 7). But among civilised people it was only known to shell fanciers until a few years ago.

FISHING.

Exhaustion of former supplies of pearl shell and the increasing demand of recent years, has promoted search for new sources of mother-of-pearl. Thus *Trochus niloticus*, or trocas, as it is sometimes called, having dense firm nacre which proved good material for buttons, came to be exploited by manufacturers. During the past six years an active request for *Trochus* by button makers has sprung up, advancing from twenty to thirty pounds a ton. The requirements of the manufacturer are that the shell shall be at least an inch and a half in diameter, taken in a living state, not encrusted with algal or coralline growths, nor penetrated by marine borers. According to Mr. Seale's figures, a row of buttons is cut from the outside of each whorl, two rows from the base and another from the partition wall within. Frequently these buttons show their origin by a trace of pink at the underside.

Vessels formerly engaged in gathering pearl shell are now often diverted to this work. The Great Barrier Reef is being fished for *Trochus* from Torres Strait southward to Port Mackay. The export of *Trochus* from Queensland in 1915 was 544 tons worth £12,000 and in 1916 was 950 tons worth £23,000. The Philippine Islands export about 320 tons annually. From Western Australia the exports of *Trochus* were: for 1912, 52 tons; for 1913, 66 tons; for 1914, 19 tons; for 1915, 73 tons; for 1916, 26 tons. There are large fisheries in New Guinea, the Solomon Islands and Fiji, of the product of which I have no particulars.

Trochus is taken by hand on the coral reefs between tide marks, but most is gathered by coloured naked divers in about two fathoms and some even as deep as six fathoms. In the deeper water search is made from the boat with a water telescope and in the water the divers use Japanese water goggles. The extreme record of depth is a statement (Watson, Rep. Chall. Zool. xv., 1886, p. 50) that the "Challenger" dredged *T. niloticus* in 12 fathoms off Levuka, Fiji.

Cleaning is done in different ways. The shell brings a better price if the attached growths and lime crusts are pared away. Sometimes the catch is arranged by spreading the shells, still containing the animal, on the beach for the blow flies to dispose of the flesh. The putrid shells are afterwards washed clean in the sea. If the shells are left too long exposed they suffer by bleaching from sun and rain and the nacre is dulled. A quicker and cleaner method is to boil out the snail, but this has the detrimental effect of slightly cracking the nacre. Sometimes a mixture of both processes is adopted, the shells being first placed in hot or boiling water for twenty minutes, then put aside to decay slightly, till the animal can be extracted with a crooked wire. The best way, that of burying in sand for a short time, does not seem to be practised in the Pacific.

But the more careful of the Japanese fishermen save both meat and shell. From ten tons of shell a ton of meat is obtainable, worth in China £20 a ton. After boiling for half an hour, the entire snail is shaken out of the shell, dried and smoked for two days. It is then ready for export. In China this smoked *Trochus* is esteemed a dainty. It is soaked in cold water till soft, cut into dice, and used as a base of a soup, like *beche-de-mer* soup. Mr. E. J. Banfield, who supplied me with this information, tried this *Trochus* soup and reports it as very palatable.

Trochus obeliscus, which is called "wabisi" at Samarai, is too thin to be of value. But an expert, Mr. W. P. Cottrell, assured me that *Angaria delphinus* would be excellent material if available in sufficient quantity.

REGULATIONS.

In Queensland the Government require a license at the rate of £3 per annum for the first ten tons, and 10s. for each additional ton, of the vessels engaged. The man in charge is also licensed at £1 a year. At Samarai, a license is charged of £1 per annum for each cutter or lugger and 10s. for each dingy or canoe.

In the Philippines it is illegal to take *Trochus* under eight centimetres (say three inches) diameter. (Seale, Philippine Journ. of Science xi., 1916, p. 262). After the reefs of New Caledonia had been exhausted by over fishing, a minimum size of 8 cm. and a close season were imposed (Compton, Geograph. Journ. xlv., 1917, p. 91). Because it is understood that the *Trochus* breeds in the warmer season, fishing is there permitted only from 1st April to 1st November.

Neither in Australasia, nor in other British possessions, are any limits set for the size or season, at which *Trochus* may be taken. The smallest size specified by Japanese buyers is $1\frac{1}{2}$ inches. It has been suggested by the Suva Chamber of Commerce that a legal minimum of 2 or $2\frac{1}{2}$ inches for the "chicken" shell would be beneficial to the industry. Some measure of natural protection is afforded by the fact that it is too troublesome and unprofitable to pick out the snails from the smallest shells. If the natives are correct in asserting that the *Trochus* come up from deep water on the reefs during the south-east monsoon, then it is probable that the species is preserved during its early stages in rough and inaccessible places at the base of the outer reefs.

The annual Australian crop is likely soon to deteriorate under the present active fishery.

EXPLANATION OF PLATES V-VI.

Fig. 1 and 2.—Front and base view, slightly reduced, of a specimen of *Trochus niloticus* from Samarai, $5\frac{1}{2}$ inches in diameter.

Fig. 3.—A shell divided vertically to show the vacated upper chambers, blocked by porcellaneous callus, and to show the pearly frame of the shell, lined and coated with non nacreous layers, reduced.

- Fig. 4.—Young specimen an inch in diameter, showing peripheral tubercles ; enlarged.
- Fig. 5.—Type specimen of *Astraliuſ pagodus* showing an earlier stage in which the tubercles were preceded by projecting scales ; magnified.
- Fig. 6.—A ſhell from which button diſcs have been cut, drawn after Mr. Seale's photograph ; reduced.
- Fig. 7.—Operculum, to ſhow the numerous ſpirals, the pivot knob on which the whole rotates and the muſcle ſcar of the under ſide ; reduced.
- Fig. 8.—Sector of ſame, upper ſide, enlarged.
- Fig. 9.—A Papuan bracelet cut from the periphery of *Trochus niloticus* ; reduced.
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THE DESTRUCTION OF BIRD LIFE IN AUSTRALIA.

By **WALTER W. FROGGATT, F.L.S.**, Government Entomologist.

DURING the last few years a somewhat heated controversy has been carried on in the columns of our newspapers regarding the cause of the destruction of our native birds. A number of writers are under the impression that by the spreading of poison baits for rabbits by means of the poison cart our birds are decreasing in numbers throughout the settled districts. These writers talk about the balance of power in nature being destroyed by the poison cart, and the advent of new plagues and insect pests that were unknown in Australia before the coming of the rabbit. They even go further and state that there were no grasshoppers, cutworm, or fly plagues in existence in the good old days of our fathers.

In these notes I propose to point out the fallacy of many of these statements, which are made by people who generalise only upon the conditions prevailing in their own locality, and are thus unable to study the problem from a broad standpoint dealing with all phases of the question.

To start at the beginning : there were insect plagues just as severe in the early days of settlement as there are at the present time, long before there could have been any marked reduction in the wild life of Australia. Surgeon Cunningham in his "Two Years in New South Wales," published in 1827, gives a graphic account of the damage caused on the farms in the County of Cumberland by great swarms of caterpillars, and specially mentions blow-flies as a pest, swarming everywhere, blowing every dead animal, and even the blankets on his bed. Martin in his "History of New South Wales," 1839, writes : "Flies are a great nuisance in summer ; one species in particular, called the blow-fly, taints and putrefies everything it touches. Caterpillars at intervals of several years swarm in incredible numbers, blighting the finest wheatfield in a few hours. Locusts are common in some parts of the colony." Eldershaw, in "Australia as it Really Is," 1854, says : "The locust is also very prolific ; the ravages of this insect upon the herbage and green crops is a serious inconvenience to the settler."

Townsend, in "Rambles and Observations in New South Wales," 1848, speaking of the Ulladulla district, says : "Caterpillars, evidently bred in the ground, sometimes suddenly make their appearance, and hang in great numbers to each stalk of wheat ; if the wheat is well advanced in ear they do not do it much injury, but they are very destructive to the young leaf of clover."

In 1870 and again in 1875 enormous clouds of locusts bred in the Riverina, and, when winged, swarmed over the whole of Victoria, long before the rabbits started their march from the southlands. Many other records of insect pests could be quoted, but these are sufficient to show that our pioneer settlers knew what insect pests were long before the wholesale destruction of bird life commenced with the advance of civilisation.

The destruction of birds began long before the poison cart came into existence. Writers of the very earliest notes on Australian natural history stated that the emu, wild turkey, native companion, and many other birds would soon be things of the past, because they were not to be found in the vicinity of the towns that were coming into existence with the advance of settlers from the coastal districts. Yet it will be a very long time before the emu will be extinct on our western plains and scrubs.

The first blow to many forms of bird life was the ringbarking of thousands of acres of our forest lands, and the consequent destruction of the food supplies of most of our arboreal insectivorous birds, which had to move out from the desolated area, where previously every tree supported its insect world. The next was the advent of the common domestic cats, which not only hunted through the parks and gardens, but also spread into the bush lands, where they grew larger and fiercer as they reverted to wild conditions and levied a heavy toll on our feathered friends,

Then came the introduction of foreign birds, which increased and multiplied owing to their cosmopolitan habits and omnivorous appetites, and they disputed the reduced food supplies of our indigenous birds. Some years ago sparrow charts were compiled by the Department of Agriculture showing all the localities where these birds were to be found. With the extension of our railways out west, sparrows have extended their range to nearly every township in New South Wales, and are frequently noticed about station homesteads a considerable distance beyond the railway terminus, where they thrive and multiply far more rapidly than any of our native species.

Though the common sparrow eats insects in the winter months when other food is scarce, it is one of those cosmopolitan omnivorous birds, so domesticated in its habits, that it clings round the towns and hamlets and destroys enormous quantities of grain, food stuff, fruit, and garden plants, the damage being quite out of proportion to the value of its services as an insect destroyer. At the same time it drives many of our more useful native insectivorous birds out of our parks and gardens.

Then came the English starling, which at first stayed around the coastal towns until, increasing in numbers, it spread from our parks and gardens into the open fields, and now ranges far and wide into our western country. It has further been artificially spread by misguided persons who, under the idea that it was a valuable destroyer of blow-flies and other insect pests, have introduced it on to their stations. The common starling is another cosmopolitan omnivorous bird that eats seeds, berries, fruits, and insects. It steals food from the fowlyards, hunts our waste lands, orchards, paddocks and gardens, and destroys much fruit, and eats wheat and other grain. As its numbers increase out of proportion to its food supplies in the days to come, it will be a very much more serious pest to the orchardist and farmer. Its admirers claim that it is a very efficient destroyer of blow-flies; but, after some years of careful observation, and the examination of many bird stomachs, I have failed to obtain any proof that it either captures blow-flies or destroys any maggots. It hunts over the open paddocks, and, with the seeds, eats up much of the insect food of our native birds more useful to the farmer, and occupies their nesting places in the hollow trees. One has only to watch the immense clouds of starlings in the New England district to understand what a difference their presence must make to the indigenous birds. Another bad habit that the starling is credited with in England is the eating of birds' eggs, and it sometimes even invades the dovecotes to devour the eggs.

Before the advent of the white man in Australia, the blacks and the dingoes systematically hunted over the whole of the great island continent and the aboriginal custom of burning off grass when thus employed must have caused the death of countless numbers of young birds. The blacks also collected immense quantities of eggs for food, and thus were a very important check upon the undue increase of bird life. The aboriginals are gone, but the wild dogs and mongrel dingoes remain, and doubtless in some districts, account for the death of many ground birds. During the last decade, however, the European fox has entered into competition with them, and is one of the most formidable enemies of all birds nesting or sleeping, either upon or near the ground. This animal was originally imported and liberated in Southern Victoria by some sporting squatters, and while it only infested the coastal districts for a number of years, it has now penetrated far and wide into our western lands. At the present rate of progress, probably only a few years will elapse before foxes will be found in every part of Australia.

The fox, agile and cunning, will eat anything, from beetles and earthworms to rabbits, and is an expert at catching birds. The noble bustard, or wild turkey, once so numerous on the plains, is one of its victims. This bird only lays one egg which is easily broken, the young nestling is easily caught, and the old bustard, sleeping among the grass, is quickly pounced upon by the night-hunting fox. An old resident of the Riverina recently told me that he often sees an odd bustard feeding round the lignum swamps, but within a few days it vanishes, and a search in the neighbourhood reveals patches of blood-stained feathers among the crabholes where Mr. Fox has dined upon wild turkey. The plovers nesting on the open plains, the wild ducks and teal with their eggs in the long grass, the native companion, with her long-legged nestlings among the crabholes and watercourses, and many other birds with similar habits, all suffer from the depredations of the fox. If the fox was regarded by the landowners as an enemy and vermin, as he really is, there might be some hope of keeping him in check, but in rabbit-infested country many squatters, if they do not protect him, at least are not active enemies, and tolerate him in return for his services in destroying the rabbits.

Newspaper writers have made many emphatic assertions that the poisoning of rabbits, and particularly the use of the poison cart, is responsible for the decrease of bird life in Australia, and the consequent increase of insect pests of all kinds, especially the blow-flies. Now, whilst not an advocate of the poison cart as the most effective method of dealing with the rabbit pest, I dispute these statements and would place the following facts before my readers.

The poison cart is a machine on two wheels containing a coulter that can be raised or lowered by the driver so that it scratches a shallow furrow in the soil. Attached is a receptacle containing the poisoned bait which is dissolved phosphorus mixed with bran or pollard, etc., into a stiff dough. This is cut off and dropped in pellets so that it falls at more or less regular intervals into the furrow. There are only two ways in which birds can be poisoned through the use of this machine. One is by following down the furrow and gobbling up the phosphorus baits, and the other through eating the internal organs of the rabbits poisoned. What birds eat phosphorus baits? An inquisitive magpie or a laughing jackass might occasionally try them, or a night-hunting curlew, seeing the bait shining, might test one to see if it was alive. But the danger to ordinary bush birds is slight. Then as to the birds that eat the dead rabbits, we find even the crows can do this with impunity when they feed upon the carcase alone, as they generally do where dead rabbits are plentiful. The creatures that suffer most from the poison cart baits are the small night-hunting marsupials, and the monitor lizards or gohannas of the bushman. These carrion-eating lizards have been killed off in hundreds in our western country through eating poisoned rabbits. Now, as these active tree-climbing lizards are the deadly enemies of all tree-nesting birds, crawling into the hollow limbs and eating both the eggs and young nestlings, I consider that the poison cart through killing them has benefited the birds a great deal more than it has harmed them. If, as some writers state, most of the small carnivorous animals in the bush have died through eating poisoned rabbits, it has doubtless altered the balance of nature, but it has swung the pendulum in favour of our birds.

The fact that the destruction of the birds that were the greatest check upon the blow-fly pest commenced, and was almost complete, long before the era of the poison cart, seems to have escaped the attention of the general critics. I refer to the carnivorous and carrion-eating birds, for these were instrumental in clearing away the offal and carrion in the old days, and were therefore most valuable in fighting the blow-flies, for they destroyed their breeding grounds and the swarming maggots.

Dingoes, wild dogs, and wedge-tailed eagles were the first enemies that the sheep men had to deal with when they entered into fresh country, and in poisoning off these pests, the squatters incidentally destroyed nearly all the smaller carnivorous eagles, hawks, and other scavengers.

In unstocked land the wedge-tailed eagles were very numerous, and caught and killed young kangaroos, full-grown wallabies, and the smaller marsupials in a most business like manner. Under the new conditions, when sheep entered the land, these birds not only devoured dead carcases but played havoc with the lambs also. I once counted forty dead eagles scattered round a freshly poisoned sheep on a newly-occupied holding in north-west Australia. One of the most numerous useful scavenger birds that used to swarm all over the inland country in old days was the whistling eagle. In the vicinity of the killing yards of any of the out-back stations, one could often count over a hundred of these handsome birds resting on the fences and surrounding trees. While this was one of the most important species, there were many others just as useful, but they have nearly all now vanished owing to the strychnine baits, and in a lesser degree to the guns of sportsmen and farmers, who look upon all hawks as vermin or enemies to the poultry yard.

The only numerous carrion birds remaining that have any important bearing on the blow-fly question, besides being active agents in destroying other insect pests like the grasshoppers and the cutworms, are the carrion crows. Notwithstanding all the damage they do in some districts to lambs and sheep, and in spite of the honest if misguided efforts of the officers of the Pasture Protection Boards, who spend thousands of pounds every year in New South Wales in paying bonuses for the heads of crows, these birds seem to be able to hold their own and increase in numbers in all the settled districts. In many places the station owners look upon the crow as a useful bird, and recognise its value as a scavenger, and, though not actually protecting it, they do not molest it.

It is claimed that magpies have been almost exterminated by the rabbit poisoning, yet in the New England country these birds have increased enormously. Last year I counted over a hundred magpies congregated on a small freshly ploughed paddock near Uralla, and driving along the roads one could almost always count a dozen or more scattered over the open grass lands. Even the dainty magpie lark holds its own, and is common in the suburbs of Sydney, in spite of the domestic cat, and the small boy with the pea rifle. The willie wagtail, blue wren, spine bill honeyeater and the silver eyes are common in our gardens, and with a little encouragement become wonderfully tame.

As regards migratory birds, it is very difficult to say if they are decreasing or not, as they usually follow their food supplies; but great flocks of wood swallows always appear with the cutworms and young locusts. The bee birds and the grauculus come south every year, and the honey eaters follow the blossoming of the eucalypts. Even the bustard or wild turkey is not so scarce as commonly imagined. A stock inspector, stationed at Moree, told me that in one morning early last summer he counted 76 wild turkeys feeding upon the plains, within four miles of the town. In some areas, owing to their wanton destruction by so-called sportsmen and week-end trippers, birds are getting scarce. In agricultural districts, however, where food supplies have increased, through cultivation and the irrigation of the land, or storage of water, bird life is increasing, and, with reasonable protection, will hold its own. It is a great pity that the members of our many Progress Associations at holiday resorts on the Blue Mountains and other places, do not take particular care to protect their local birds and so give an added charm to their beauty spots.

In New Zealand, where a great deal of the land has been completely denuded of the indigenous forest to make room for grass and crops, the farmers have been urged to replant clumps of trees to attract the birds back to their old hunting grounds. Some writers have suggested in our newspapers that this method, if adopted in Australia, would counteract the disposal of our birds. This proposal is made because the writers know very little about the actual conditions prevailing over the greater part of Australia. In spite of the extensive clearing and ringbarking on the coastal districts, and the absence of trees on the great plains of the south west, a large area of our land is either open forest or park-like flats, covered with a wonderful variety of shrubs and scrub-trees, which afford shelter for all kinds of birds. Water is, of course, essential to the birds, and wherever it is present, they will be found. The bushman and explorer always watch the flight of the birds in the dry lands, which usually leads them to water. Even in our suburban gardens, if a dish of water is regularly left under the garden taps, it is wonderful how soon all the birds in the neighbourhood find it and come regularly to drink and wash. In north-west Australia I used to travel up the "police track" between Derby and Hall's Creek, where for some fifty miles through the dry sandy pindan scrub the only water obtainable was from shallow wells, with a bucket, windlass and trough rigged up for travellers. Often these troughs were dry, and hundreds of small birds, finches, doves, etc., were seen around the well, trying to get a drink. When one hauled up a bucket full of water and poured it into the trough, the sight of the fearless thirsty birds clustered over the water was enough to warm the heart of any man.

In Central Australia there are regular cycles when for two or three years hardly enough rain falls to moisten the surface of the earth; and all animal life vanishes. The wonderfully adaptive desert dwellers, frogs, lizards, snakes, and insects bury themselves deep down in the cool earth, while the birds fly away and the marsupials migrate beyond the dry belt. Then comes the life-giving rain, inch upon inch falls, the resting seeds in the soaked soil respond, and the land is covered with herbage, grass and flowers. The dormant life of the underworld creeps up to the surface, the water in the ponds and clay-pans teems as if by magic with small crustaceans and water insects. The shrubs burst forth into new foliage and flowers, and birds come winging their way back to new food supplies.

Sometimes when Australia suffers from a long-continued drought, thousands of birds and animals perish from want of both food and water; or, during a heat-wave, when for several days the temperature rises to 120° in the shade, accompanied by a hot wind, birds fall dead from its effects if they cannot reach water, while many of the late nestlings are found dead in their nests. On such days birds, such as crows, magpies, jays and magpie larks, may be seen along the track, clinging to the shade of the

trees, with their beaks open. Rabbits, driven from the shelter of the bush on to the open plain die very quickly, while even foxes have been found dead apparently from the effects of the heat wave.

The multiplication and expansion of bird life all over Australia is regulated by the conservation of water. As the pioneer settlers move towards the interior, making great excavations, or tanks, in the catchment areas in which to hold the rain of wet years to tide them over the rainless periods, there will be no lack of birds to beautify the landscape with their presence.

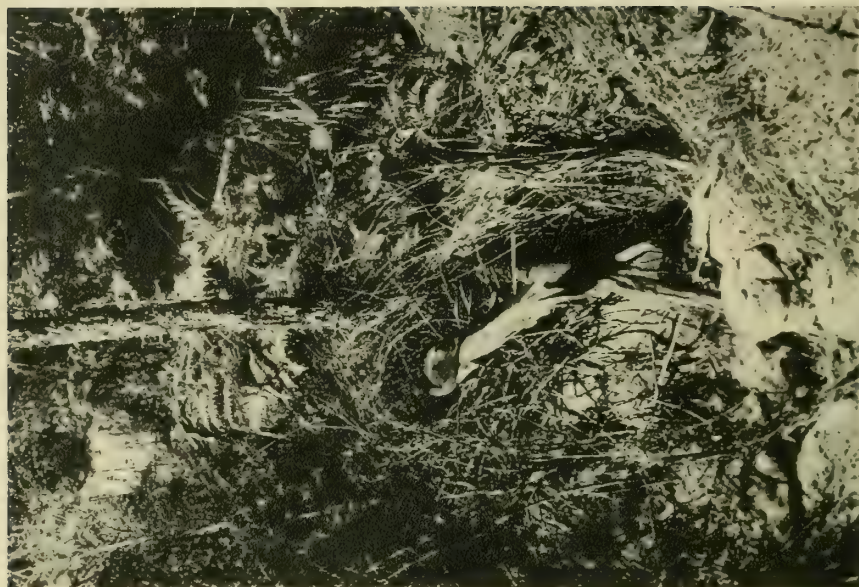


Fig. 2.



Fig. 1.

LYRE BIRD AND NEST.



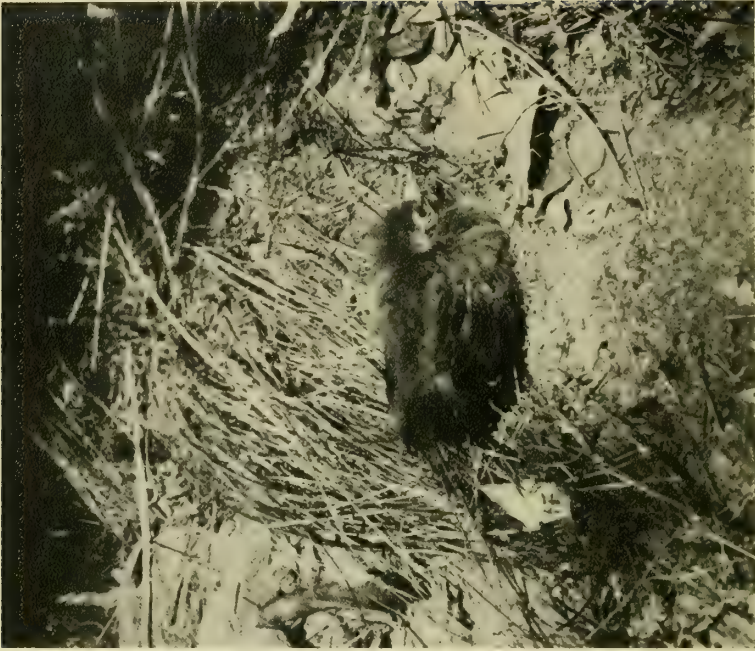


Fig. 4.

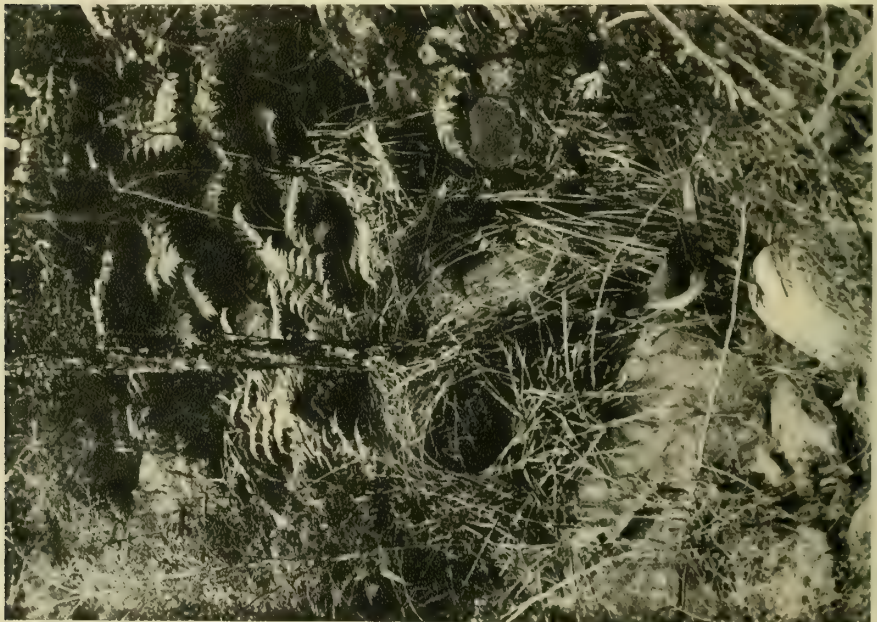


Fig 3.

LYRE BIRD. NEST, AND YOUNG.

THE LYRE BIRD: SOME NESTING NOTES.

By JOHN RAMSAY and ALBERT E. KEENE.

(Plates VII.—VIII.)

[THE Lyre Bird, *Menura novae-hollandiae*, Latham, is the most attractive subject for the pen and camera of Australian bird lovers; numerous articles have been written upon it, and many beautiful photographs have been reproduced in ornithological literature. The pages of the "Emu," the organ of the Royal Australasian Ornithologists' Union, in particular, contain some striking illustrations of these birds and their nests, the work of Dudley Le Souëf, L. G. Chandler, A. E. Kitson, Sidney W. Jackson, and others.

The accompanying plates, supplied by Mr. John Ramsay, a son of the late Dr. Ramsay, formerly Curator of the Australian Museum, and Mr. Albert E. Keene, of Ashfield and Point Clare, near Gosford, will be welcomed, as illustrating the female Lyre Bird in positions hitherto unrecorded by photographers. They are accompanied by notes containing much that is entirely new in relation to the habits of the bird during the period of incubation of the egg.—A. F. BASSET HULL.]

A Lyre Bird was heard calling on the range at the back of Point Clare, near Gosford, New South Wales, on 26th June, 1916, so a careful search was instituted, with the result that, when least expected, the female bird was flushed from a nest containing a warm egg. The nest was a typical one of the species, placed on a flat rock at the base of a sapling, and surrounded by a wealth of ferns and scrub, on the steep slope of a dry watercourse. On again inspecting the nest on 1st July, the egg was found to be quite cold, and fears were entertained that the nest had been deserted, but a "hiding-tent" was placed in position near the nest and left overnight. At 9.30 a.m. on the 2nd July, the egg was still cold, and there was no sign of the parent bird. About 1.30 p.m. she appeared, looking very anxious and wary. For half-an-hour she made a careful inspection of the tent and surroundings, even peering through the opening at the photographer, Mr. Keene, who, with cramped limbs, hardly dared to breathe for fear of scaring her away again. Satisfied at last she stepped on to the stone below and in front of the nest, paused a moment, and was "snapped." At the click of the shutter she darted away, and after waiting half-an-hour in the hope of her return, the photographer left without seeing her again. On the following Sunday (9th July) the egg was examined and found to be quite cold at 9.30 a.m., and the bird was not heard approaching until 11.30 a.m. She appeared to be feeding on the way, never ceasing to scratch as she gradually approached. She was obviously less timid than on the previous occasion, but made a careful inspection of the tent, as before, putting her head within a foot or two of the entrance and peering through the narrow opening. All being still, she walked again to the stone and leaped lightly and easily on to the nest, a distance of at least three feet. Hardly pausing, she entered the nest, turned round, and settled herself on the egg.

After leaving her for some little time, the photographer showed himself at the side of the tent, when she slipped out of the nest and ran off, though apparently not greatly frightened. She was heard scratching close by during the next half hour, and then, after the usual inspection, she returned to the nest, and was allowed to remain undisturbed.

This procedure was maintained until the 30th July. At 9 a.m. each day the egg was found to be cold, and there were no signs of the bird, although the greatest caution was observed in approaching the nest. She would be heard scratching in the vicinity about 11 o'clock, and invariably approached by the same route, from the back and to the right of the nest. (Plate vii.). Each day the tent was thoroughly examined, and she continued to intermittently scratch up to the moment of stepping on the stone, from whence she sprang into the nest, but once settled on the egg, she allowed the photographer to stand in front of the nest without leaving it, and took no notice of the camera shutter.

On the 30th July the young bird was found hatched, but the parent was absent from 9 till nearly 11.30 a.m., after which she visited the nest at intervals of about half-an-hour until the observer left between 2 and 3 p.m. Although she was obviously engaged in feeding the young bird on each visit, and was in full view at a distance of a few feet, no sign of food in her bill could be detected, nor was she seen to clean the nest.

On 13th August an interesting note was made. On going to the nest, the young bird, then about a fortnight old, was found standing stiffly erect, in such a manner that its body was above the level of the nest opening, and pressed against the inside of the dome-shaped roof. In this position, even a careful scrutiny would only reveal two dark stick-like legs, and anyone seeing this remarkable attitude could only conclude that it was another example of nature's protection of the helpless.

On the last-mentioned date the young bird was removed from the nest and photographed (Plate viii.) the parent being in such a state of excitement the while that she would venture within a few feet of the observer. During the whole time she kept up a running fire of calls, whistles, and peculiar throaty noises, accompanied by the young bird in a series of squeaks. The combined noises created quite a volume of sound, which increased when the young bird temporarily escaped and had to be chased through the undergrowth. He was recaptured and replaced in the nest, and, contrary to experience with many other species, quietly remained there. The tent and camera were packed up, the birds ceased calling, and five minutes later all was quiet.

At no time during the period the nest was under observation was the male Lyre Bird either seen or heard.

Twelve months later (22nd July, 1917), Lyre Birds were calling in the same locality.

KANGAROOS IN CAPTIVITY.

By H. L. WHITE, Belltrees, Scone, New South Wales.

"In captivity" may be hardly the correct term to apply to the state of my animals; "under restraint" is probably more suitable. A fifteen-acre paddock accommodates a flock of about thirty kangaroos and a few wallabies, and, excepting during a couple of winter months or an exceptionally dry summer, they require no artificial feed. But their pasturage now shows signs of over-stocking, and requires a rest.

Some thirty years ago I commenced keeping pet kangaroos about the house, allowing them to run at liberty. Their end being usually caused by visiting dogs, I erected a small wire netting enclosure of about an acre. In this I kept a large grey kangaroo and a few wallaroos. The first-named became father celebrated; he was of immense size and named "Ben," a wonderful fighter and very bad tempered. Upon several occasions he broke the wire netting by kicking it when teased, and he half-killed a couple of men who ventured into his domain; he was eventually destroyed. Before "Ben" became savage, it was amusing to watch him approach the gardener when the latter used the hose. "Ben" would come right up to the netting, and when the man played the hose upon him, would turn round slowly, lifting his arms meanwhile, so that every portion of his body might get a thorough wetting.

About ten years ago I enclosed fifteen acres of land adjoining the house garden with a six-foot fence of netting and barbed wire. In this paddock were placed specimens of all the species of kangaroos and wallabies I could conveniently secure, most of them being pets. I have found hunted-down or trapped animals do not usually live; they either pine away or break their necks in the fence. I have had better success in this respect with wallabies than kangaroos.

My stock now consists of 15 Wallaroos, *Macropus robustus*, 10 Grey Kangaroos, *M. giganteus*, and 5 Red Kangaroos, *M. rufus*. They all breed freely, wallaroos rather better than the others—in fact my chief trouble is to keep the number of the last named within reasonable limits.

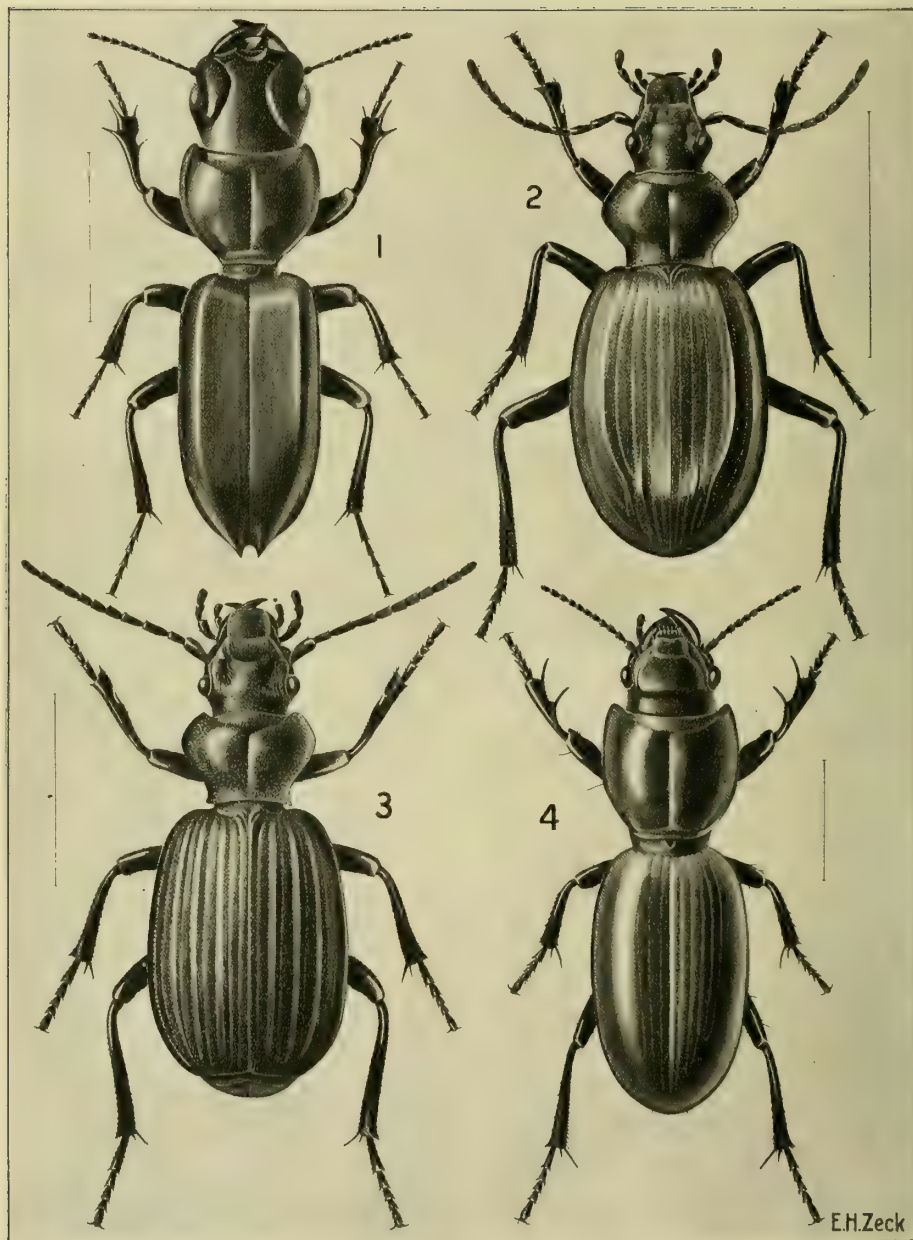
When my paddock becomes overstocked, I reduce the numbers by letting some of the animals loose. This would appear an easy matter, but is very far from it. If an attempt is made to drive the kangaroos through the gate, there is trouble at once, very little excitement causing them to dash into the fence, when serious injuries often result. They will not face the opening, but run or jump over both man and horse attempting to stop or turn them. I erected a small yard in one corner of the paddock, which opens into a shed where water, rocksalt and feed is placed. It is made of 10 feet iron, fastened upright to stout timber, and has a very small gate opening into the outer lands. During a very dry spell the hungry animals will enter the yard as soon as food is put out; then, watching an opportunity the gate is closed behind them by means of a long string pulled from some distance away. Say that a dozen kangaroos are trapped, wild excitement ensues, the larger animals trampling on the smaller, fighting with one another, and attempting to scramble over the fence. In the midst of this I enter armed with a bamboo rod having a noosed rope at the end. The selected animal is roped and immediately dragged out through the small gate, and either popped into a crate for transmission to the Zoo, or let loose. Before the yard is opened into the paddock again several of the smaller kangaroos are killed or crippled by the larger ones, while amongst the last named a broken neck or leg is not a rarity. Even after the animals are set at liberty, trouble does not end. The majority will not leave the vicinity; some jump back into the paddock, others are killed by dogs, while a very few take to the bush. Upon one occasion I liberated two very large male grey kangaroos by coaxing them into a lane, driving them $1\frac{1}{2}$ miles along it, and over a river which they had to swim; they were both back next morning. I let them into the paddock again, re-trapped, and sent them off to Sydney Zoo.

Many battles are fought between males of the different species, the wallaroos usually winning, though not altogether by "playing the game." While the grey and red kangaroos are satisfied in attempting to rip with their hind claws, the wallaroo is an artist with his teeth as well as claws. While striking, the whole weight of a kangaroo is supported by the tail. The kick, which will rip a dog open, and the thud of which can be heard at some distance, does not appear to cause much injury to the combatants.



A Kangaroo can raise itself upon its toes, and in fighting, can support the whole weight of its body upon its tail as it strikes with its powerful legs.

During the last few months foxes have killed all my smaller wallabies, including the "Striped Thigh" and "Paddymelon"; the "swamp" or black wallaby appears to escape, being much faster than those previously mentioned. It may not be out of place to mention that of late years, wallabies, kangaroo rats, and opossums have almost disappeared from this locality. Five years ago these animals were present in thousands, shooters and trappers paying large sums for the right of collecting skins. Now, in spite of the close season, the animals mentioned have practically disappeared, owing to the depredations of foxes. Grey kangaroos and wallaroos, however, are holding their own, and are present in fair numbers. The red kangaroo is not indigenous to this district.



ILLUSTRATIONS OF AUSTRALIAN COLEOPTERA.

By A. MUSGRAVE and E. H. ZECK.

(Plate IX.)

RECOGNISING the necessity of reliable figures for the elucidation of species of Australian Coleoptera, it is the intention of the writers to publish plates from time to time, illustrating unfigured forms. We are led to undertake this work owing to the difficulty we have encountered in identifying material which has fallen into our hands from descriptions alone. Thousands of unfigured species have been described, many of them inadequately, and many in foreign journals which can only be referred to by those who have access to the libraries of our several scientific institutions. The undertaking offers many difficulties and the present contribution is a very small one. We nevertheless hope that the work here begun will prove useful.

The four species here figured were described by Mr. T. G. Sloane in the Proceedings of the Linnean Society of New South Wales, and the specimens on which our illustrations are based have all been examined by him.

Family CARABIDAE

Tribe SCARATINI

CARENIDIUM LEAI, Sloane.

(Plate IX., fig. 1).

Carenidium leai, Sloane, Proc. Linn. Soc. N.S. Wales xxii, 1897, p. 223, and xxx., 1905, Suppl. p. 17.

Drawn from one of a series of three specimens collected at Cue, West Australia, by Mr. H. Brown.

Measurements of specimen figured—Length 26.8 mm., breadth 6.8 mm.

Tribe BROSCINI.

EURYLYCHNUS CYLINDRICUS, Sloane.

(Plate IX.; fig. 4).

Eurylychnus cylindricus, Sloane, Proc. Linn. Soc. N.S. Wales, xli., 1916, p. 199.

The specimen figured is one of ten paratypes collected at Barrington Tops, Mount Royal Range, New South Wales, in December, 1915, by Messrs. H. J. Carter and A. Musgrave. The species is common under logs in the Beech Forests at an altitude of 4,500 to 5,000 feet.

Measurements—Length 18.5 mm., breadth 5.6 mm.

Tribe HELLUONINI.

HELLUAPTERUS NIGER, Sloane.

(Plate IX.; fig. 3).

Helluapterus niger, Sloane, Proc. Linn. Soc. N.S. Wales, xxxix., 1914, p. 591.

Our figure represents a topotype collected by Mr. H. Brown at Cue, West Australia. It is 30 mm. long and 12.2 mm. broad.

HELLUARCHUS ROBUSTUS, Sloane.

(Plate IX. ; fig. 2).

Helluarchus robustus, Sloane, Proc. Linn. Soc. N.S. Wales xxxix., 1914, p. 593.

The figure of this very unique species is prepared from a topotype collected at Ankertell, West Australia.

Its measurements are—Length 38 mm., breadth 15 mm.

Mr. Sloane points out in the paper quoted that "The strangely shaped elytra of *Helluarchus*, which are those of an integripenne and not a truncatipenne, make this one of the most abnormal forms to be found amongst the Carabidae, and place it quite by itself. Its affinity is evidently towards *Helluapterus*. In general appearance *H. robustus* resembles the genus *Cuneipectus*."

THE DEPOSITION OF THE EGGS OF MONOTREMES.

By HARRY BURRELL.

IN his book "In the Australian Bush," p. 162, Semon expresses the belief that the mother Echidna places her egg in the pouch by means of her long muzzle, and not with her clumsy limbs. From personal observation, however, I am inclined to think that such a method is quite unnecessary, if not incorrect. I have examined several adult females "in season" when the pouch is fully developed, and on three occasions, after persuading the animals to unfold themselves from their Pill-bug-like balls, have found fresh excreta deposited in their pouches. This suggests that the egg may be similarly deposited directly into the pouch, without the assistance of either limbs or beak.

The same idea may also throw a gleam of light on the secret method acquired by the pouchless platypus in both the laying and hatching of her eggs. Though it is generally supposed that the eggs are laid in the nest, there is no information as to the process of incubation, so a little theory on this subject may prove of interest. Having examined the tunnels and breeding chambers of *Ornithorhynchus*, I find that the nesting recess is too small to permit an adult animal to sit bird-like in comfort on the eggs, while it does not seem feasible to suppose she props her tail against the side wall of the cavity, or allow it to hang out and become an obstruction in the subway. The platypus always sleeps coiled up with the tail tucked beneath the abdomen, and in this posture she could easily deposit her eggs on the slightly concave under surface of the tail, which, when clasped to the body, becomes a serviceable substitute for a pouch. If she should require to go in search of food while incubating, it would be quite simple for her to transfer the egg or eggs to the nest, and just as easy to replace them again on her return. Having studied the Platypus in captivity as well as in its natural haunts, I am convinced that most of the principal duties are performed with its active and powerful fore-limbs. When climbing, walking, or tunnelling, the membrane is conveniently folded back into the palm of the hand, and when quietly swimming the hind-legs are trailed inertly behind with the tail. In grooming or scratching itself, this quaint contortionist squats "tripod fashion" on its haunches, and imitates every antic peculiar to a flea-infested monkey. This evidence is surely sufficient for one to surmise at least the possibility of a Platypus possessing the ability to manipulate her eggs or even the newly-hatched young, if necessary, with her soft, rubber-like hands.

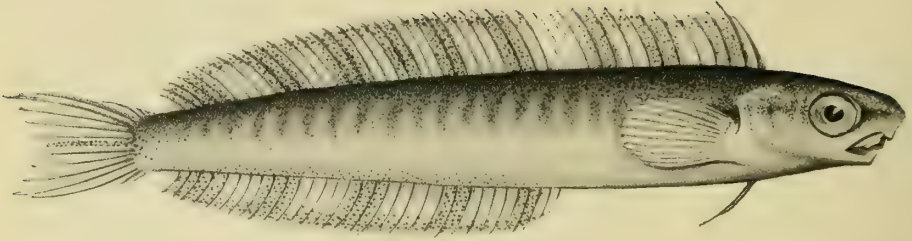


Fig. 1. *Aspidontus maroubrae*.

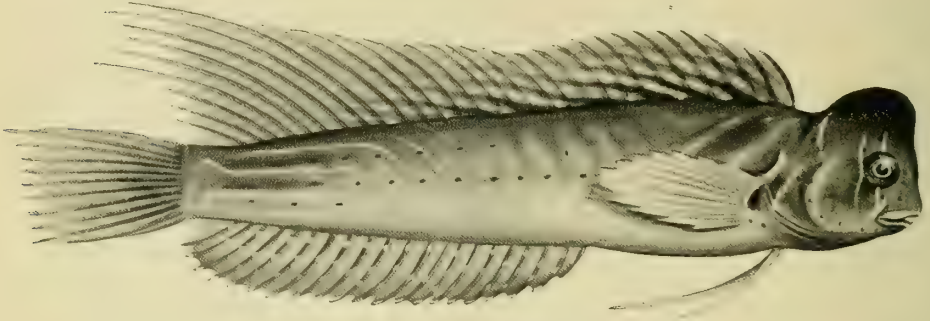


Fig. 2. *Petroscirtes anolius*.

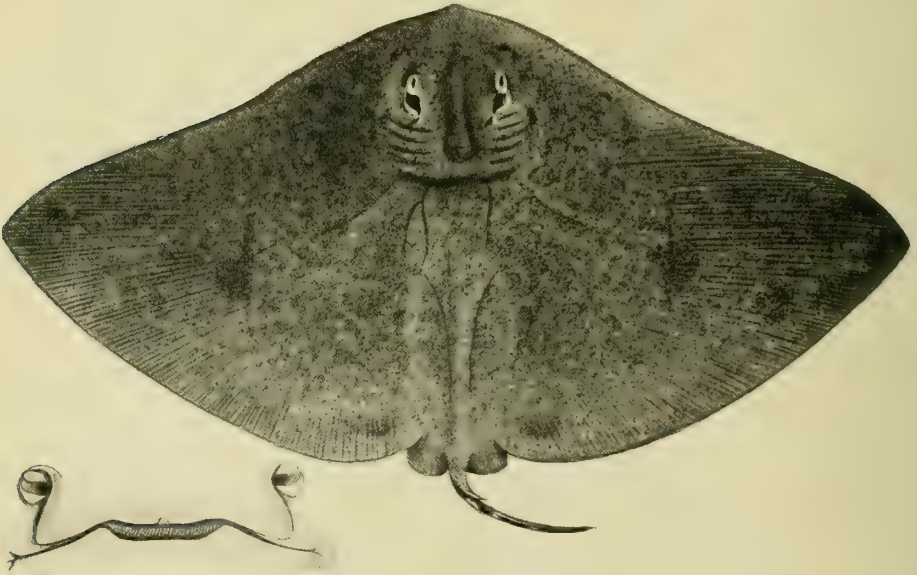


Fig. 3. *Pteroplatea australis*.

ICHTHYOLOGICAL NOTES.

By ALLAN R. McCULLOCH, Zoologist, Australian Museum.

(Contribution from the Australian Museum).

(Plate X.)

THE following notes deal with the nomenclature and status of several genera and species of fishes from New South Wales, which have been brought under consideration during the course of a revision of the list of fishes recorded from the waters of this State. By the acquisition of fresh specimens of *Pteroplatea australis* and *Petroscirtes anolius*, I have been enabled to prepare figures of these species, while an examination of the holotype of *Aspidontus maroubrae* has enabled me to correct several errors in its original description.

Family DASYBATIDÆ.

PTEROPLATEA AUSTRALIS, Ramsay & Ogilby.

(Plate x. ; fig. 3.)

Pteroplatea australis, Ramsay & Ogilby, Proc. Linn. Soc. N.S. Wales, x., 1886, p. 575, and *Loc. cit.* (2), ii., 1888, p. 1024. *Id.*, Ogilby, Ann. Qld. Mus., No. 9, 1908, p. 5.

Length from the snout to the end of the ventrals 1.8 in the width. Tail 2.8 in the length. Narrowest inter-spiracle width 1.2 in the space between the eyes; width of the spiracle 5.07, and bulge of the eye 4.7 in the same. Mouth as wide as its distance from the end of the snout. Internasal width 1.4 in the preoral length.

Disc less than twice as broad as long, its greatest width being at about the middle of its length. Snout acute, not produced. Anterior margins sinuous, the outer angles obtusely pointed, and the posterior margins very slightly convex. Eyes small, elevated above the surrounding surface. Spiracles large, sub-quadrangular; the interspiracle width less than that between the eyes. Nostrils with free, angular lobes posteriorly. Outer angles of the internasal valve produced into obtusely pointed lobes; the posterior margin sinuous, interrupted on the median line. Teeth small, each with a single cusp. Skin of the back smooth; a short tentacle behind each spiracle. Tail with a short, thick spine inserted a little behind the posterior margins of the ventrals; a low keel is present on the superior and inferior surfaces of the tail.

Colour.—Disc greenish grey, variegated with lighter and darker areas, and speckled with small, light grey spots with darker centres. Symmetrically disposed darker patches are present in front of the eyes, exterior to the spiracles, on the sides of the pectorals and near their posterior angles. Tail black above, white below, the white encroaching upon the sides to form two or three incomplete annuli. Lower surfaces white, darker towards the margins of the disc.

Described from a specimen 712 mm. wide.

Garman¹ has united this species with *P. tentaculata*, Müller & Henle, but it apparently differs in the details of its colour-marking, while its dorsal fin is often wanting. The absence of this fin has been used to distinguish *Alloplatea* from *Pteroplatea* in which it is present, but the specimens of *P. australis* in the Australian Museum prove that this character is not constant even within the limits of a species.

Loc.—The example upon which this description and figure is based was presented to the Australian Museum by Dr. S. J. Johnston. It was obtained at Tuggerah Lakes, New South Wales.

1. Garman—Mem. Mus. Comp. Zool. Harvard, xxxvi., 1913, p. 411.

Family SOLEIDAE.

Genus SOLEICHTHYS, *Bleeker*.

Soleichthys, *Bleeker*, Act. Soc. Reg. Sci. Ned. Ind. vi., 1859, p. 183 (*S. heterorhinos*, *Blkr.*). No definition.

This genus is well distinguished from *Solea* by a combination of smaller characters. The upper anterior nasal tube is greatly developed instead of small, overlapping the eye. The gill-membranes are connected with the rayed portions of the pectorals instead of with their bases. The right pectoral is formed of several partly free rays, the upper of which are much longer than the others; in *Solea* the fin is rounded with the rays completely united by membrane. The lower surfaces of the dorsal and anal rays are naked, except in the posterior portions of the fins, while they are scaly in *Solea*. The eyes are juxtaposed instead of separated, and the lower lip bears a more or less developed fleshy tubercle in *Soleichthys*.

Soleichthys is related to *Synaptura*, subg. *Zebrias*, through *S. japonicus* *Bleeker*. That species agrees in all its characters with *Soleichthys* except that the dorsal and anal fins are united with the basal half of the caudal. It differs from *Zebrias* in having the anterior nasal tube produced, and the lower surfaces of the dorsal and anal rays almost entirely naked.

The genus is represented in New South Wales waters by *S. microcephalus*, *Günther*.

Family BLENNIIDÆ.

Genus BLENNIUS, *Linnaeus*.BLENNIUS TASMANIANUS, *Richardson*.

Blennius tasmanianus, *Rich.*, P.Z.S., 1839, p. 99, and Tr.Z.S. iii., 1849, p. 129; *Waite*, Rec. Austr. Mus. vi. 3, 1906, p. 205, pl. 36, 5.

Blennius castaneus, *Macleay*, P.L.S.N.S.W. vi., 1881, p. 5 (Not *B. castaneus*, *Castelnau*, 1861).

The only specimen now in the *Macleay* Museum labelled as *B. castaneus* is a single example said to have been obtained at Port Stephens, whereas *Macleay*'s type was secured in Port Jackson. It has sixteen instead of thirteen dorsal rays as described, and is completely bleached. It is identical with *B. tasmanianus*, and I think it probable that *Macleay*'s description of *B. castaneus* is inaccurate, and really refers to the same species.

Genus PETROSCIRTES, *Ruppell*.PETROSCIRTES ANOLIUS, *Cuvier & Valenciennes*.

Oyster Blenny.

(Plate x.; fig. 2).

Blennechis anolius, *C. & V.*, H.N.Poiss. xi., 1836, p. 288.

Petroscirtes anolis, *Gthr.*, Cat. iii., 1861, p. 238.

Blennius unicornis, *Castelnau*, P.L.S.N.S.W. iii. 4, 1879, p. 384.

? *Petroscirtes guttatus*, *Macleay*, P.L.S.N.S.W. vi. 1, 1881, p. 9.

Petroscirtes cristiceps, *Macleay*, *Ibid.*

Petroscirtes wilsoni, *Macleay*, P.L.S.N.S.W. ix. 1, 1884, p. 171.

Salarias galeatus, *de Vis*, P. Roy. Soc. Qld. i., 1884, p. 147, and *Ibid* ii. 1, 1885, p. 59.

Petroscirtes anolius, *Ogilby*, P. Roy. Soc. Qld., xxiii., 1910, p. 50.

Synonymy.—To the synonymy of this species, as given by Ogilby (*Loc. cit.*), I would add *Blennius unicornis* Castelnau, the very brief description of which applies well enough to some specimens in the Australian Museum collection.

I have examined the types of *P. wilsoni* and *P. cristatus*, which are preserved in the Macleay Museum, and find them quite similar, and synonymous with *P. anolius*. Macleay counted only twenty-six rays in the dorsal, but I find there are thirty.

The two typical examples of *P. guttatus*, also in the Macleay Museum, differ from the typical *anolius* form in having only rudimentary cephalic crests, in having no filamentous dorsal rays, and in having the caudal fin rounded. The anterior profile of the head is oblique, so that the snout is pointed, and the colour-marking consists principally of several rows of dark spots on the body. D. xii./18; A. 21-22. In all other characters they are quite similar to *P. anolius*, of which I regard them as the female form.

A co-type of *Salarias galeatus*, de Vis, from St. Helena, Moreton Bay, is preserved in the Australian Museum. It differs from de Vis' descriptions in having well developed upper and lower canines, but it is doubtless an authentic example. It does not differ from *P. anolius*.

Variation.—Fourteen specimens, 37-80 mm. long, which I identify as *P. anolius*, indicate that this species undergoes considerable variation with growth. The elongate rays of the dorsal and caudal fins are only filamentous in larger specimens. The development of the cephalic crest varies greatly; it is absent in small specimens, and rudimentary in what I suppose to be females, but it increases in size in adult males until its height is equal to the length of the post-orbital portion of the head. When the crest is well developed, the anterior cephalic profile is subvertical, but it is more or less oblique in others, so that the snout appears pointed.

Old spirit specimens exhibit striking transverse, angular, darker bars on the sides, which become oblique anteriorly, and horizontal posteriorly; these are much less evident in fresh specimens. The smaller examples bear several rows of dark spots on the sides posteriorly, which may be coalescent into horizontal lines.

Figure.—The specimen figured is 69 mm. long, and was found in an oyster-shell forwarded to the Sydney markets, by Inspector Smithers. It was alive upon its arrival here, and so enabled me to illustrate more of its colour-marking than can be observed in preserved specimens.

Localities.—Fourteen specimens are preserved in the collections of the Australian Museum and the Macleay Museum from the following localities:—New South Wales: Jervis Bay, Port Jackson, Hawkesbury River Estuary, and Tweed River Estuary. Queensland: Moreton Bay and Caloundra.

PETROSCIRTES ROTUNDICEPS, Macleay.

Petroscirtes fasciolatus, Macleay, P.L.S.N.S.W. vi., 1881, p. 8 (not *Omobranchus fasciolatus* Ehrenberg).

Petroscirtes rotundiceps, Macleay, *Ibid.*, p. 9.

Salarias furtivus, de Vis, P. Roy. Soc. Qld., ii., 1886, p. 60.

Petroscirtes macleayi, Ogilby, Cat. Fish. N.S.W., 1886, p. 38, substitute name for *P. fasciolatus* MacL.

Petroscirtes furtivus, Ogilby, P. Roy. Soc. Qld., xxiii., 1910, p. 48.

Synonymy.—The two typical examples of *P. rotundiceps* preserved in the Macleay Museum are structurally similar to those of *P. fasciolatus* and *P. furtivus*. They are very bleached, but still show a dark post-orbital spot and same blue lines on the sides which are similar to those of the other species. D. xii./22; A. 24.

P. fasciolatus is represented by twelve examples in the Macleay Museum, while five cotypes of *P. furtivus* are in the Australian Museum, which enable me to verify the synonymy given by Ogilby.

ASPIDONTUS, Quoy & Gaimard.

Aspidontus, Quoy & Gaimard, Voy. Astrolabe iii., 1834, p. 719 (*A. taniatus*); Weber, Siboga Exped. lvii., 1913, pp. 539, 543.

Macrurrhynchus, Ogilby, P.L.S.N.S.W. xxi., 1896, p. 136 (*M. maroubra*); Weber, *Ibid.*, p. 539.

Macrurrhynchus is here regarded as synonymous with *Aspidontus*, as was originally recognised by Ogilby. Weber (*Loc. cit.*) considered them distinct on account of some differences in the form and position of the gill-opening: in *Aspidontus* it is in front of, and as wide as the base of the pectoral; it is before the upper half of the pectoral-base in *Macrurrhynchus*, and is equal to about two-thirds its width. The two genera appear similar in all other characters.

Aspidontus appears to be distinguishable from *Petroscirtes* in having the gill-opening partly or entirely before the pectoral base instead of above it; the snout is conical and produced beyond the mouth; canine teeth present only in the lower jaw.

ASPIDONTUS MAROUBRÆ, Ogilby.

(Plate x.; fig. 1).

Macrurrhynchus maroubra, Ogilby, P.L.S.N.S.W., xxi. 2, 1896, p. 137.

D. 12 (+2 ?), +31; A. 32; P. 12; V. 2; C. 11. Length of head, from end of snout to gill-opening, 4.6 in the length from the snout to the base of the caudal rays; depth of body 6.5 in the same. Eye 3.4 in the head, slightly longer than the snout. Interorbital space wider than the eye, 3.1 in the head. Gill-opening 1.8 in the eye, and 1.5 in the width of the pectoral base. Median pectoral ray 1.7 in the head, inner ventral ray 2.3 in the same. Second dorsal ray 2.1, twenty-fifth dorsal ray 2.3 in the head. Total length, from the snout to the end of the middle caudal rays, 50 mm.; head 9½ mm.

Body elongate, compressed, deepest above the abdomen. Snout conical, deep, projecting beyond the mouth, which is sub-inferior. Eye large, slightly longer than the snout, but not quite as wide as the interorbital space; the latter flattened. Posterior angle of the mouth extending almost to below the middle of the eye; anteriorly it forms a transverse opening, defined by the parallel upper and lower jaws and by the mandibular canines; the upper and lower jaws fail to meet in the type so that there is always a wide aperture anteriorly. Teeth in a single series in each jaw, fixed, flattened; the upper are subvertical, and much larger than the lower, which are almost horizontal; upper jaw without, lower jaw with a large, tusk-like, curved canine on each side, which extends forward in advance of the other mandibular teeth. Lips thin, not covering the teeth anteriorly, and forming a broad flap on each side of the upper jaw. Nostrils close together, lateral, the posterior the larger, and in a low tube; they are placed midway between the eye and the end of the snout, almost on the angle between the upper and lateral surfaces of the snout. Some minute pores regularly distributed over the head. Gill-opening reduced to a small foramen before the upper angle of the pectoral-base.

All the fins composed of simple rays. Dorsal fin originating almost above the preoperculum, and slightly in advance of the ventrals. It appears to have been composed of forty-five rays, of which the thirteenth and fourteenth are missing; the only trace of them remaining is a break in the continuity of the fin, and two scars where their bases might have been. The second ray is a little longer than those succeeding it, after which the rays increase slightly in length towards the middle of the fin, and then gradually decrease backwards. Anal similar in form to, but lower than, the dorsal, commencing beneath the fourteenth ray, and terminating evenly with that fin on the caudal peduncle; last dorsal and anal rays attached to the peduncle by membrane. Pectoral rounded. Ventral with two rays enveloped in thick membrane, the inner the longer. Caudal emarginate.

Colour, after preservation in alcohol, brownish above, lighter below, with numerous brown bars on the upper half of the sides. Fins transparent, the dorsal and anal with several dark bars composed of minute blackish dots, and with a narrow marginal band of the same; median caudal rays similarly dotted.

A re-examination of the type and unique example, with better microscopical appliances than were available to Ogilby, shows his description to be inaccurate in several details. These include the structure of the dorsal and ventral fins, the position of the nostrils, and the dentition. I have therefore redescribed it above, with particular attention to the details wherein his description differs from mine.

EXPLANATION OF PLATE X.

- Fig. 1.—*Aspidontus maroubrae*, Ogilby. Type, 50 mm. long, from Maroubra, New South Wales.
- Fig. 2.—*Petroscirtes anoliis*, Cuv. & Val. A specimen 69 mm. long, from the Manning River estuary, New South Wales.
- Fig. 3.—*Pteroplatea australis*, Rams. & Ogil. A specimen 712 mm. wide, from Tuggerah Lakes, New South Wales.
-

**THE GREAT BLACK PALM COCKATOO, *MICROGLOSSUS ATERRIMUS*,
IN CAPTIVITY.**

By Dr. E. A. D'OMBRAIN, M.R.A.O.U.

IN July, 1912, Mr. W. R. McLennan sent me two young examples of the Great Black Palm Cockatoo from the Cape York Peninsula. They reached me safely, and were to have been forwarded to Dr. W. Macgillivray, at Broken Hill, but the weather being very cold, and their food requiring much attention, I decided not to send them on so long a train journey. I took them to my residence at Cremorne, Sydney, and housed them in a warm place, keeping them in their box-cage, but nevertheless found one dead on the following morning.

Even greater care was taken with the remaining bird. In addition to being kept near an oil stove at night, a hot brick, wrapped in flannel, was placed in the box. This treatment carried it safely through its first and second winters, but was later dispensed with as the bird became acclimatised.

Size and Colour.—The total length, from the base of the upper mandible to the tip of the tail, is 22 inches; the tail and the wing each measure 10 inches. The bill of this specimen is $3\frac{1}{2}$ inches long, and that of the young one which died measured $3\frac{1}{4}$ inches; the late Mr. A. J. North, of the Australian Museum, recorded a length of 4 inches. The longest feathers of the crest measure $8\frac{1}{2}$ inches.

The general colour is a glossy metallic black, with the exception of the lores and feathers about the base of the mandibles, where the glossy appearance is replaced by a soft, velvety black. The cheeks are quite naked and of a peculiar soft, wrinkled character, and when the bird is in good condition, and warm enough, are of a bright scarlet colour. If not well, or feeling the cold, however, the cheeks become purplish red, which suggests pallor or bad circulation.

The feathers of the cheeks are capable of as much movement as those of the crest. They can be thrust directly forward, or laid straight in the usual direction. When cold, or when the bird is quiet or dull, these feathers are used to cover not only the naked cheeks, but also the whole of the lower and part of the upper mandible, which gives the bird a very grotesque appearance, as though wrapped up.

Before the first moult, much of the breast and lower abdomen presented a freckled appearance, due to the feathers bearing rows of faint, light dots arranged in parallel lines. It is noteworthy that these markings are persistent in the Funereal Cockatoo. The irides are of a dark brown or hazel hue, which gives the eyes a very mild and gentle expression.

The so-called thighs are quite bare, and slaty-blue in colour. The legs, or tarsi, are black. The tongue, like all other soft parts of the gape, is scarlet, except at the tip, or about 6 millimetres of its length, which is quite black. The hinder part of the dorsum of the tongue is provided with a bifurcated prolongation which forms a sort of lid to a depression or cavity immediately below it. In my bird, all the feathers are kept constantly dusted over with white powder, which gives it the appearance of being slaty-grey, and detracts from the beautiful glossy black plumage. This is procured from a gland over the back of the coccyx or end of the spine, and the method of its application is very interesting. The head, with the crest lowered, is thrown right back until it reaches the gland. It is there covered with powder by a lateral rubbing motion, which is repeated a few times. Then the head is used as a powder-puff over the rest of the body, including the under surfaces of the wing feathers. Mr. McLennan tells me that the birds are found powdered like this in their native state. Most Cockatoos, such as Corellas and the Sulphur-crested species, keep themselves clean by means of this powdering, but none apply it in this manner.

Food.—Mr. McLennan took these nestlings when they were just feathered, and fed them on soft food, such as boiled rice, later getting them on to boiled barley. With this they were being fed by hand when I received them, but I shortly changed the diet of the one that lived to boiled wheat, filling its crop by hand at each feeding. At this time I also attempted to induce it to eat mixed bird-seed by always leaving some in the tin, and noticed it selected buckwheat from the rest. Each seed was held in the manner usual to the parrots and cockatoos, but the seed-case was split open along its line



The Great Black Palm Cockatoo stands very erect upon its perch. The use of its peculiarly constructed mandibles is explained in the accompanying article.

of cleavage exactly in halves. All nuts, hempseed—the main article of diet at present—fruit-stones, greenpea pods and the peas therein, are carefully opened along their line of fissure. Mr. McLennan found the birds living on the kernels of a very hard nut, the botanical name of which I have been unable to ascertain. These nuts are so hard that it takes a strong blow with a tomahawk to crack them, and are about the size of a large filbert nut. If the bird is given a walnut, the line of union of the two halves is first discovered and cleaned of any softer fibrous material. Then the chisel-edged lower mandible is inserted carefully, and with great pressure, the halves are separated right along till they come apart. This method is always employed in reaching the contents of seeds, and evidently explains the object of the finely-pointed upper mandible (see figure), and also the chisel edge of the lower mandible.

All food is taken in very small particles and transferred by a backward action of the tongue to the cavity before mentioned on the posterior part of the tongue. Here it remains until a sufficient quantity has been collected to fill the cavity, when it is passed on to the crop. I have dealt with the method of feeding in detail because of the singular manner in which the bird, with its huge Macaw-like mandibles, takes its food, the meticulous care being utterly unlike that of any other bird, and in sharp contrast to the usual method.

As the accompanying figure shows, there is a solid, anvil-like mass of upper mandible which is corrugated underneath, on which the chisel-like edge of the lower mandible works. The mandibles are exceedingly powerful, and can easily open the strands of a wire clothes-line, or make indentations in a threepenny piece. This fact necessitated my having a special woven wire cage made for my bird.

Mr. McLennan describes the nesting cavities, which are generally in a vertical hollow branch or trunk of a bloodwood tree, as having an arrangement of split wood, some inches in depth, and placed crosswise at the bottom. This is evidently a sanitary arrangement to prevent the nesting cavity becoming foul from the oil contained in the nut kernels of the bird's food. If mine is given a piece of wood to bite at, it always splits it along the grain in its whole length, and in pieces about the thickness of a match.

This bird proves to be one of the most gentle I have ever seen in captivity. It is quite impossible to make it bite, and when annoyed, it merely uses the fine point of the upper mandible in a scratching manner, accompanied by a little sharp dig or peck. It is full of mischief, and delights in any noise, becoming very excited at the passing of a train. A curious characteristic is that when the bird hears us turn a high-gear'd carborundum sharpening wheel, it immediately hangs head down from the top of its cage, with all its feathers flung widely out or almost reversed, just as it does in a shower of rain or when the spray of the hose is turned on it. This is evidently due to an association of ideas of rain and the sound of it falling on the earth. This habit may always be displayed to visitors at any time.

The bird has a not unpleasing, high-sounding whistle, when excited or when playing, in addition to some deep base notes almost like those of a raven. The call most often produced is like the words "Cheroo, chereea," produced from the larynx with the mandibles wide open. This call is whistled in times of excitement, the "reea" part being repeated many times in rapid succession.

The feathers of the crest are almost always erect, and some of the longest cross near the tips, as shown in the illustration. The only time at which the crest is laid in repose is either when the bird is feeding or when quiet at rest. The bird stands on both feet on the perch when sleeping, not with one drawn up as with most perching birds, and the bill is turned round and buried in the feathers in the usual manner. The claws are very strong and sharp pointed, and I have to see that they are suitably clipped before one can take the bird on the finger.

The bird is very timid of sudden movements of one's hands, especially if they are on either side of it. Frontal movements are less noticed, and I fancy this fact indicates that the visual activity is greater on either side than directly in front. Another peculiarity is the position of the tongue when at rest. Its bulbous black tip is held between the chisel-like edge of the lower mandible and the rectangular surface of the projecting portion of the upper one in much the same manner as the tongue of some animals, such as horses and cats, is held between the front teeth of both jaws.

The agility of the bird is remarkable. It can spring or jump with both feet from a verandah rail on to a table, the two being separated by a distance of over two feet. An actual measured jump was 29 inches. When very young the toes were not turned in in walking, and this continued for some time, to be altered later into the characteristic gait of Cockatoos. The whole of the tarsus is used for walking on, and in such a way that a sort of pad or heel is formed at the proximal end. As the illustration shows, the bird stands very erect.

CONTENTS OF PART 1.

	Page
Report of the Council for 1913.....	1
The Mallophaga as a possible clue to Bird Phylogeny, by Launcelot Harrison, B.Sc.....	7
Bird Sanctuaries, by A. F. Basset Hull.....	13
A Monograph of the genus <i>Tisiphone</i> , Hübner, by G. A. Waterhouse, B.Sc., B.E., F.E.S.....	15
A new Victorian Araneiad, by W. J. Rainbow, F.E.S.....	21
Notes on the Breeding-habits of the Purple-striped Gudgeon, <i>Krefflius adpersus</i> , Castelnau, by Albert Gale.....	25
A new Australian Caprellid, by the Rev. Thomas R. R. Stebbing, M.A., F.R.S., F.L.S., F.Z.S....	27
Notes on some Australian Syngnathidae, by A. R. McCulloch.....	29
Bird Notes from the North-west of New South Wales, by Walter W. Froggatt, F.L.S.....	33
An Interesting Exhibit, by A. S. Le Souef, Director, Zoological Gardens.....	35

CONTENTS OF PART 2.

Report of the Council for 1914.....	37
List of Members, 1914.....	41
Bird Notes, by Walter W. Froggatt, F.L.S.....	44
Two Beetles apparently new to Australia, by W. J. Rainbow, F.E.S.....	46
The Migration of the Jolly-tail or Eel Gudgeon, <i>Galaxias attenuatus</i> , from the sea to fresh-water, by A. R. McCulloch.....	47
Further notes on the genus <i>Tisiphone</i> , Hübner, by G. A. Waterhouse, B.Sc., B.E., F.E.S.....	50

CONTENTS OF PART 3.

Report of the Council for 1915.....	53
Some new Araneidae from the County of Cumberland, by W. J. Rainbow, F.E.S.....	58
Notes on Colour-variations of Opossums of the genus <i>Trichosurus</i> , by A. S. Le Souef, Director, Zoological Gardens.....	62

CONTENTS OF PART 4.

	Front Pages
Report of the Council for 1916	
The Royal Zoological Society of New South Wales. Its present position and future aims, by A. F. Basset Hull, President.....	65
The Economics of <i>Trochus niloticus</i> , by Charles Hedley.....	69
The Destruction of Bird Life in Australia, by Walter W. Froggatt, F.L.S.....	75
The Lyre Bird: Some Nesting Notes, by John Ramsay and Albert E. Keene.....	81
Kangaroos in Captivity, by H. L. White.....	83
Illustrations of Australian Coleoptera, by A. Musgrave and E. H. Zeck.....	85
The deposition of the eggs of Monotremes, by Harry Burrell.....	87
Ichthyological notes, by Allan R. McCulloch.....	89
The Great Black Palm Cockatoo, <i>Microglossus aterrimus</i> , in captivity, by Dr. E. A. D'Ombain, M.R.A.O.U.....	95

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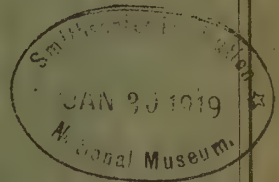
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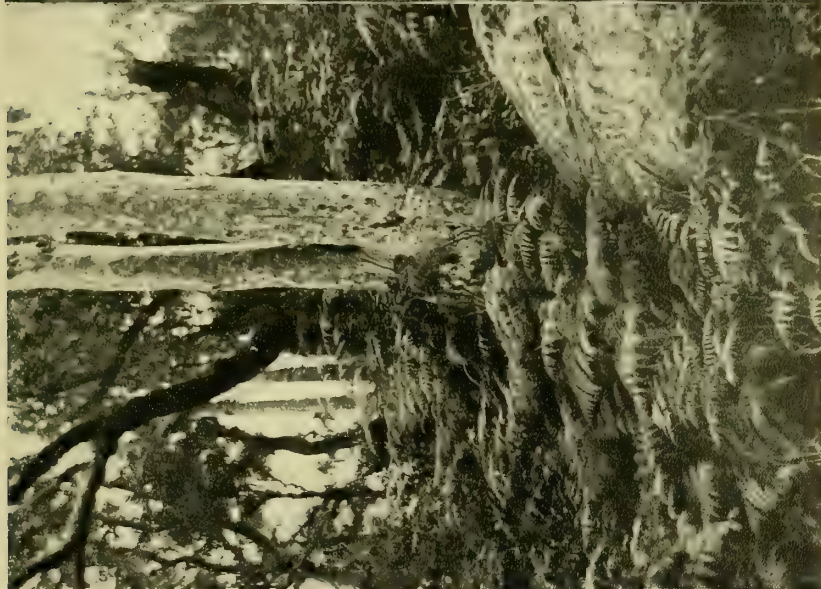
PRIVILEGES:

Ordinary Members—Free admission to Taronga Zoological Park; Additional Tickets admitting 20 Adults or 40 Children; Free Copy of "Australian Zoologist."

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THE POLAR BEAR PIT.
Photo. by Mrs. CLIFFORD COLES.
TARONGA ZOOLOGICAL PARK.



ORIGINAL SITE OF THE BEAR PIT.
Photo. by W. F. MACLEAN.



THE SITE OF THE MONKEY PIT.

Photo. by W. F. MACLEAN.



VIEW FROM TARONGA PARK.

Photo. by W. F. MACLEAN.

TARONGA ZOOLOGICAL PARK.

TARONGA ZOOLOGICAL PARK.

(Plates xi.-xii.)

In their Report for the year ended 31st December, 1916, presented to Parliament during the session of 1917, the Trustees of the Taronga Zoological Park trace the events which led up to the adoption of the present site, and state that all the Trustees, and, with the exception of Mr. J. Davis, all the advisory Trustees, were members of the Zoological Society, and were selected as possessing the requisite experience and knowledge for laying the foundation of this great national undertaking.

In general character the land, some 60 acres in extent, consisted in its natural state of a series of plateaus or grassy slopes, rising one above the other to a height of some 340 feet from the water level, in a succession of terraces faced with precipitous rock or weather-worn masses of boulders, well wooded with angophora, eucalyptus, eugenia, banksia, grevillea, and other trees, shrubs and ferns common in the coastal districts.

Plans were made for the subdivision and laying out of the land, and in August, 1912, the work of construction was commenced. Four main roads were marked out, running east and west, following the sweeping contour of the terraces, with a central avenue crossing them, and tracks and paths intersecting them in many places, giving access to the numerous glens and gullies which nature had provided in abundance. In 1915 the construction was taken up by the Public Works Department, under the Director General, Mr. J. Davis, whose name, together with that of the Government Architect, Mr. George McRae, must always be associated with this important enterprise.

The Trustees acknowledge with gratitude the great assistance so freely given them by experts in the several branches of scientific knowledge both outside and inside the Public Service, including Mr. J. H. Maiden (Director of the Botanic Gardens), Mr. J. Dawes, Professor W. A. Haswell, Mr. D. G. Stead, Mr. W. W. Froggatt, and Mr. Albert Gale.

The construction work was far enough advanced by the middle of 1916, to justify the transfer of the animals to their new quarters from the Moore Park Gardens. The task was a difficult one. It was however, successfully accomplished by the Secretary, Mr. A. S. Le Souef and his staff; and the Zoological Gardens at Moore Park were finally closed (after a useful career of thirty-eight years as a public institution) on Saturday, 1st September, 1916.

The official opening of the Taronga Zoological Park took place on Saturday, 7th October, 1916, the ceremony being performed by the Premier, the Hon. W. A. Holman, M.L.A., in the presence of a large concourse of guests of the Government. The first step taken in popularising the new institution was to introduce it to the children of the Public Schools in the metropolis. Arrangements were made for some three thousand children to be conveyed by tramcar and steamer to the Park each day, until 120,000 of them had visited the animals in their new homes.

Construction work proceeded vigorously up to the end of 1916, and, although much remained to complete those portions of the grounds that are now available for use, the Park had established itself in public favour as a place for young and old to resort to for enjoyment and enlightenment.

Pictures and maps accompanying the report indicate the character of the country as nature made it, and the manner in which it has been adapted to the requirements of a public park, and a place where living animals can be properly kept and exhibited for study and entertainment. The original trees and shrubs have been preserved as far as possible; and, though it has been found necessary to clear much for the profit of what remains, and to make room for roads and buildings, advantage has been taken of every opportunity for new planting, with the object of restoring the character of the scenery, and of concealing the necessary artificial structures which have been introduced, as well as of providing shelter and shade. Except in so far as flowering plants are concerned, which are necessary for decorative colour effect, nothing but Australian trees, shrubs, palms and ferns have been added, and it is intended that the most beautiful flowering trees and shrubs of Australia, capable of cultivation in the Park, shall find a place there.

The space allotted to the collection of animals occupies about 30 acres in the central portion of the area; and this has been divided into sections to enable the several orders and families to be appropriately grouped. Wherever practicable, the enclosures have been specially constructed to provide what each kind of animal requires in accordance with its habits and mode of life. Where possible also, the method of caging animals has been abandoned; and the concealed impassable moat and the barrier of real and artificial rock have been substituted for the erstwhile rigid lines of iron bars which inevitably suggest imprisonment.

The accompanying illustrations (Plates XI. and XII.) show the original state of the present sites of the monkey pit and the bear pits; the latter in its present state, and a view from the grounds overlooking the harbour.

ROYAL ZOOLOGICAL SOCIETY OF NEW SOUTH WALES

NEW MEMBERS.—The following have been elected :—

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Associate Members : E. Ashby, A. C. Brownhill, Dr. Brooke Nichols, R. D. Low, W. Low.

RULES.—In pursuance of the powers contained in Article 40 of the Articles of Association, the Council has made the following Rules :—

1. *Capital Fund.*—In order to effectually carry out the objects of the Society, a Capital Fund is established, and the following moneys shall be paid into such Fund :—

- (a) All unconditional cash donations and benefactions.
- (b) The subscriptions of all Life Members admitted on and after the 31st day of October, 1917.
- (c) Such amount as the Council may from time to time vote from the balance standing to the credit of the annual income account, until a sum equal to £10 10s. in respect of each Life Member of the old Society has been so voted.
- (d) All sums received by way of fines under the Birds Protection Act, 1901, and the Native Animals Protection Act, 1903.

2. *Annual Income.*—The annual income shall consist of :—

- (a) All subscriptions paid by Ordinary and Associate Members.
- (b) Interest and dividends derived from investment of the Capital Fund.
- (c) Sales of publications, and
- (d) Such other income as the Council may from time to time determine,

3. *Sale of "The Australian Zoologist."*—"The Australian Zoologist" may be sold at such price per part as the Council may fix in respect of future issues. The parts already issued may be sold at the undermentioned prices, until further ordered:—Part I., 3s.; Part II., 2s.; Part III., 2s.; Part IV., 3s.

MEMBERS OF COUNCIL.—Dr. George Henry Chapman has been appointed Professor of Pharmacology, and Dr. Stephen Jason Johnston has been appointed Professor of Zoology, University of Sydney. Mr. A. F. Basset Hull has been appointed Honorary Ornithologist to the Australian Museum, Sydney.

LIFE MEMBERS OF THE OLD SOCIETY.—All Life Members of the old Society are entitled to Life Membership in the Society without payment of any subscription. It is only necessary for them to sign the undertaking to abide by the Memorandum and Articles of Association, a copy of which has been forwarded to their last known address.

CONTRIBUTIONS TO "THE AUSTRALIAN ZOOLOGIST."—All members are invited to contribute articles or notes on matters of zoological interest, accompanied, where possible, by drawings or photographs.

THE DISTRIBUTION OF *ANASPIDES* AND *OOPERIPATUS* IN TASMANIA

By Professor T. Thomson Flynn, B.Sc., University of Tasmania

THE two genera *Anaspides* and *Paranaspides*, which are the Tasmanian members of the group Syncarida, have in recent years been the subject of great interest on account of their primitive organization, their relation to certain fossil groups of archaic character, and their limited distribution. The former genus was founded by Thomson for a small shrimp-like Crustacean found on Mount Wellington, Tasmania, which he named *Anaspides tasmaniensis*; later this was collected by G. O. Smith, and its distribution extended to the Harz Mountains, Mount Field, and Mount Read.

The purpose of this note is to give some further information on the distribution of *Anaspides*. It evidently does not occur in the Great Lake, but in 1914, during the visit of the British Association to this locality, *Anaspides* was found in a small stream entering the Lake on the south-eastern side. It is possible that the habit of *Anaspides* of moving about in the open waters or over the surface of moss, etc., has contributed to its extinction in the waters of the Lake, which contains large numbers of English fresh-water fish; *Paranaspides*, which is only known from the Great Lake, has escaped this fate, possibly through the protection afforded by its colour and its habit of living among weeds.

In January, 1916, in company with some other Hobart gentlemen, I visited Cradle Mountain, North-west Tasmania. Mr. Eustace Maxwell, a member of the party, brought me a number of *Anaspides* which he had collected between Barn Bluff and Cradle Mountain, at a height of about 3000 feet. These additional records bear out Smith's statement that *Anaspides* will probably be found on most of the western highlands of Tasmania.

In the Proceedings of the Linnean Society of New South Wales for 1890, Fletcher drew attention to a specimen of *Peripatus leuckartii* in the collection of the Macleay Museum, which was labelled as coming from Tasmania. In 1894, Professor Baldwin Spencer recorded the discovery of *Peripatus insignis*, Dendy, at the Dee Bridge in Tasmania; this species had previously been found only in Victoria.

I have been unable to find any specimens of *P. leuckartii* in Tasmania, and, so far as I know, Fletcher's solitary record remains unconfirmed.

With regard to the other Tasmanian member of the group, which now takes its place in the genus *Ooperipatus*, I am able to extend its distribution to the Great Lake, where some half-dozen specimens were obtained in four or five days by a party of the British Association in 1914, and to the bank of the Cascade Creek, in the neighbourhood of Hobart, where I found a single female in the spring of 1916. Further search at the time and since has not yielded any specimens.

BIRDS IN MY GARDEN.

By HENRY L. WHITE, of Belltrees, Scone, New South Wales.

PROBABLY in no other place in New South Wales are as many birds to be seen on an equal area as have been observed on the ten acres surrounding "Belltrees House," on the Upper Hunter River.

This area comprises flower beds, lawns and shrubbery, containing a considerable number of native eucalypts, and on it 104 species of birds have been noted. A complete list may not be of much interest, so I shall confine my remarks to the more interesting birds.

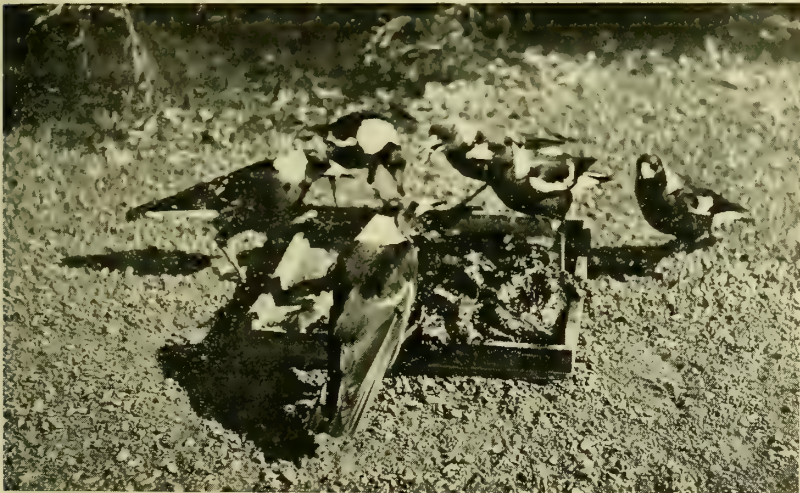
First place must be given to the common Magpie (*Gymnorhina tibicen*), it being a permanent resident and present in large numbers.

During the last three winters I have fed the Magpies regularly upon liver, my plan being to drive a long nail through an old box cover, the cover is laid flat with the nail protruding, and a whole bullock's liver is placed on it.

The birds are fed three times every week, the quantity of meat they consume being remarkable.

The establishment here being a large one we kill regularly, and I am thus enabled to keep up a supply of liver for my pets.

In order to protect the meat from cats, the board is covered every night; early in the morning I remove the cover, and within a minute the board is surrounded by birds who had just previously welcomed me with a chorus. Very few quarrels occur during meal time. About fifty Magpies are fed regularly, few of them appearing to breed.



Black-backed Magpies (*Gymnorhina tibicen*) feeding on bullock's liver.

Photo. by SID. WM. JACKSON.

In the early winter they are in splendid plumage, but by September many look the worse for wear, having broken tail feathers and discoloured plumage.

After eating their fill of liver the birds play about on the lawns and flower beds, frolicking like young lambs; a few genuine fights occur, when feathers fly in all directions; but, as a rule, the games are harmless to themselves and amusing, though causing a good deal of damage to flowers and small plants. In fact, I found it necessary to place wire netting over many of the plants as a protection.

Occasionally a bird picks a leaf or flower and runs off with it, closely pursued by half a dozen mates. When collared (as we say in football) the flower carrier turns on to its back, and still holding fast to its prize defies, with claws in air, anyone to take it. A general scrimmage then takes place, birds from all parts of the garden flying in to take part. The leaf or flower being torn to pieces, the game ends.

It is most interesting to watch the Magpies digging for grubs when the ground is moist after a shower. The croquet lawn appears to be the favourite resort of a large white grub which greatly disfigures the surface by throwing up small mounds of soil. As many as a dozen birds may commence operations by watching the grass most intently, usually with head turned to one side. Of a sudden a dash is made, a hole bored or dug, and a fine juicy grub carefully withdrawn, banged on the ground once or twice, and then eaten. A mistake is very seldom made, though at times the hole is three inches deep. I have watched most carefully through a powerful pair of glasses, but never observed the slightest movement of the surface. How the bird locates a grub three inches under ground is a mystery to me. Great care is exercised in drawing the grub out of its hole, at times a gentle strain being kept on for a couple of seconds.

After one of these grub hunts the lawn presents quite a dilapidated appearance—holes punched everywhere, while grass and roots are scattered broadcast. However, I prefer this state to the unsightly worm casts.

As soon as the warm weather comes I cease feeding the Magpies, when many of them leave the garden and take up their abode for a time about the butcher's boiling-down plant, where they presently assume a very greasy and disreputable appearance. During summer time all the birds obtain their natural food from the grass paddocks, frequently returning to the shady trees in the garden during the heat of the day.

During November, 1917, the Magpies developed a new habit, viz., that of roosting on the house, especially on the spouting round the balconies.

Upwards of 20 birds availed themselves of this novel roost, though plenty of suitable trees are in the vicinity.

About 4.30 a.m. the birds began to sing in chorus, and kept it up for more than an hour before starting away to feed, much to the disgust of the occupants of the adjoining bedrooms. About 7 p.m. the birds retired to the roof, but made sudden, short, sharp flights around until 7.20, when their last song was heard. During the night one often heard some of the more restless birds moving on the iron spouting.

In December several young Magpies were seen on the lawns, their feeding by the old birds being very amusing at times. A large biscuit dropped on a path by a child was carried by a parent bird to its young one on the lawn; after being carefully broken into small pieces the biscuit was fed to the juvenile until the latter became fairly crammed with the dry food and would take no more.

Next in point of numbers comes the Currawang (*Strepera graculina*), who is not a welcome, though interesting, guest. Appearing in great numbers during April, when the white cedar berries begin to turn yellow, this bird remains until the late spring, disappearing from the garden then to breed in the mountains.

Although a fine bird, with many pleasing notes and ways, the Currawang is not a favourite being the chief medium for the spread of that national curse, the "Prickly Pear." I have seen pear seeds in the birds' droppings miles away from the nearest known plant; a passage through the digestive organs appearing to greatly hasten the germination of the seed. During its stay with us the Currawang is a tame and stupid bird, frequenting the garden in dozens. When in the mountains it is a shy, wide-awake fellow. Numbers of the birds are shot during winter for fox baits, but they are not readily scared away.

They eat anything—meat, insects, fruit and berries being on their menu; they assist the Magpies in disposing of the liver, fill themselves with pepper tree berries which they drop into the house spouting, and thereby choke the down pipes, strip off juniper and privet berries, and dig up an occasional worm.

The Yellowtail or Tit (*Acanthiza chrysorrhoa*) is useful and numerous. They collect into flocks and desert the garden during winter, returning in early spring, when they build in almost every suitable bush. They eat immense quantities of aphids from the rose bushes, and are energetic, jolly little chaps.

The Diamond Sparrow (*Slaganopleura guttata*) is quite as numerous as the Tit, but far less useful, feeding almost entirely on seeds and young herbage. They are present all the year round, and breed freely. I have counted ten nests, new and old, in one large rose trellis.

Wagtails (*Rhipidura tricolor*), Jacky Winters (*Microeca fascians*), and Peewits (*Grallina picata*) remain in the garden all the year round, and nest freely. The White-shafted and Rufous Fantails (*Rhipidura albiscapa* and *R. rufifrons*) are occasional visitors, but always welcome.

Of Quail I have noted four species, but this family appears to prefer the adjoining grass land.

Peaceful Doves (*Geopelia placida*) are numerous, in spite of many falling victims to tame cats, the bird being a ground feeder, stupid, and easily caught.

The Pectoral Rail (*Hypotaenidia philippensis*) is a rare visitor, and the only one of the family noted.

The Plover family are represented by the Spur-winged, Black-breasted and the Black-fronted Dotterel, the two first named being too shy to become regular residents. The same applies to the Stone Plover (*Burhinus grallarius*), whose mournful call is not so frequently heard since the advent of the fox, several of which I have poisoned in the garden.

The Straw-necked Ibis and White-fronted Heron appear on the lawns occasionally on Sunday, during the absence of the gardeners; the Night Heron has been noted also. Wood Ducks come sometimes at night to feed on the irrigated lawns. Black Ducks frequently fly over, while on one memorable occasion a broken-winged Swan was discovered, injured by either mistaking an iron roof for water or flying into the telephone wires.

The Gréy and Common Goshawk (*Astur clarus* and *A. fasciatus*, the latter a frequent visitor), Sparrow Hawk (*Accipiter cirrhocephalus*), and Little Falcon (*Falco lunulatus*) have been shot while attacking fowls or pigeons. The other birds make an unmistakable fuss when these marauders are about.

Brown Hawks, Whistling Eagles, and an occasional Wedge-tailed Eagle have been seen about the garden. The beautiful little Black-shouldered Kite and Nankeen Kestrel are useful, and therefore never interfered with.

Owls are represented by three species, viz., Boobook, Winking, and Delicate (*Ninox boobook*, *N. conniens*, and *Strix delicatula*); they are all useful as vermin killers, though I had to destroy a "Winker" who took a fancy to young fowls.

Honey-eating parrots visit me when figs are ripe, and make plenty of noise right at my office windows. Three species have been noted, viz., Blue Mountain, Musk and Little Lorikeets; the last named I have seen killed with sticks while feeding in my fig trees.

The common Sulphur-crested Cockatoo is very numerous in the district, and odd ones are seen close to the house. Both the Yellow and Red Tailed Black Cockatoos have been noted in the eucalyptus trees near the garden.

During severe droughts in the interior both Cockatoo Parrots and Budgerygars (*Calopsittacus novæhollandiæ* and *Melopsittacus undulatus*) have visited the garden.

Rosellas and Red-rumped Parrakeets are very common, both breeding in artificial nesting boxes placed in some of the higher trees. While I write six full-plumaged Lories (*Platycercus elegans*) are in a tree near by.

A Podargus or Frogmouth (*Podargus strigoides*), Little Nightjar (*Aegotheles novæhollandiæ*), Dollar Bird (*Eurystomus pacificus*), and a Nightjar, which I suppose to be *Eurostoopus albigularis*, are occasional visitors. The Jackass (*Dacelo gigas*) is always with us, his ridiculous laugh being one of the first bird notes heard in the morning and last in the evening.

Apropos, the term "Jackass to Jackass" is an old-fashioned way of expressing a long day's work in the bush. Master Jack is not above making a mouthful of smaller birds, nestling Wood Swallows being considered a special dainty.

Two other Kingfishers, the Sacred and Red-rumped, visit us every summer, the first named breeding in an artificial nesting place.

Last summer a pair of Pardalotes (*P. ornatus*) hatched young in one of my nesting spouts, but had no further luck; a Sacred Kingfisher put in a claim, destroying nest and young, and appropriating the hole for itself.

The beautiful Bee Eater (*Merops ornatus*) is a regular visitor. No less than seven cuckoos have been seen in the garden, five of them breeding. I found the unusual number of three eggs of the Pallid Cuckoo (*Cuculus inornatus*) in a Honey Eater's nest.

The Black-eared Cuckoo (*Misocalius palliolatus*) is seen occasionally, and its egg of a dark chocolate colour has been taken in the locality.

The Channel-bill Cuckoo (*Scythrops novæ-hollandiæ*) is fond of figs, my trees attracting them occasionally. Sometimes called the "Rain" or "Storm Bird," from the fact of its being unusually noisy during stormy weather, it frequently calls at night, also when flying over from range to range.

Four of the Swallow family are plentiful, the latest comer being the Black and White (*Cheramæca leucosternum*). It turned up some ten years ago for the first time, and is now quite common; it is a curious instance of what was supposed to be an inland bird moving into the eastern district. Like others of the family, it is fond of perching on the telephone wires.

Two Cuckoo Shrikes (*Coracina robusta* and *C. mentalis*), the first named a resident, are in evidence, as is also *Lalage tricolor*—all useful birds, but *Coracina robusta* is rather given to fruit-eating; it nests in the garden. One species of Babbler (*Pomatorhinus frontalis*), and the Chough (*Corcorax melanorhamphus*), both noisy birds, visit us in fair-sized companies, and have been known to breed, though they prefer the bush.

One Wren (*Malurus cyaneochlamys*) only has been noted, some years in considerable numbers. They breed close to my office, the male being a pugnacious little chap, having great fights with his own reflection in the glass of the windows. A Grallina once played the same game, and had to be shot because it made such a mess of the windows.

Of Wood Swallows, *Arlamus tenebrosus* is a resident, while *A. superciliosus* and *A. personatus* arrive in swarms when the summer inland is dry. For some time I was sceptical about the sordid Wood

Swallows roosting in bunches, but proved the fact at length. Each of the three species breeds here, the white-browed in vast numbers at times, almost every bush, stump, or post being utilised as a nesting site. The Harmonicus Thrush, one of our most delightful songsters, but of a retiring nature, and seldom seen in numbers, nests in a juniper tree close to my office. It is a mystery why a bird like the Thrush does not increase in numbers; it is encouraged everywhere, but shows no noticeable increase such as exhibited by the Magpie, Raven, and other birds.

Two species of Butcher Birds are among my guests. The Grey birds (*Cracticus destructor*) live here during winter, frequently sharing the Magpie's food. They probably breed within the enclosure. While the small native birds do not appear to fear the "butcher," the imported Sparrow is in mortal dread of him, and often falls a victim. Some two years ago I noted quite a number of sparrows hanging by the neck in forks of a shrub which was evidently used as a larder by the Butcher family. The Black and White Butcher Bird (*C. nigrigularis*) is not a regular visitor, but occasionally its beautiful clear note is heard. During the winter of 1915 two pairs lived here and shared the Magpies' food.

Thickheads and Whitefaces breed regularly, the last named generally in the very early spring in artificial nesting sites.

Zosterops, Dicæum and Pardalotes (two species) turn up very regularly, the last named nesting in my artificial spouts or in the weep holes of a brick retaining wall.

Of a number of Honey Eaters noted, the most interesting is the Blue-faced (*Entomyza cyanotis*) who comes along pretty regularly when the coral tree (*Erythrina*) blooms. A curious habit with these birds, and one I have not seen previously recorded, is that several times during the day small parties, after a lot of chattering, settle for a moment on high trees about 200 yards apart, then with loud cries charge in the air; a very short fight(?) ensues, and both parties return to their respective feeding places.

The Oriole (*Oriolus sagittarius*), one of our best mimics, is partial to figs, and puts in an appearance every year. A visitor that I always encourage is the Satin Bower Bird (*Ptilonorhynchus violaceus*), a few appearing during winter months, but never a full-plumaged male. At the present time there are four in the garden, living chiefly on berries, though seedlings and herbage are not overlooked. The natural note of the bird is unpleasant, being a sort of loud hiss, but occasionally some fine imitations of other birds are given, though the tone is low.

A dense creeper close to my office is a favourite place, one or more birds playing about in it, and giving the imitation calls for an hour at a time, while they dance along a horizontal branch.

In the spring of 1915 I had hopes of a pair breeding, as they commenced to build a bower, a sure sign amongst the family (*Ptilonorhynchidae*) that courting has begun; however, the birds left soon after without my expectation being realized.

Last, but by no means least in matter of importance, is the Raven, who is plentiful but shy and extremely wary.

So much uncertainty exists about the Raven and Crow that I have been to some pains to prove identification of the local bird. Our Pastures Protection Board pays a bounty upon "Crow" heads, about 2400 being received per annum.

I have had an opportunity of examining many of these, received reports upon others, and have not been able to find a solitary "Crow"; the heads have all been taken from Ravens (*Corone australis*). The bird may do some good as an insect destroyer, but this is far outweighed by his destructiveness; many hundreds of sheep are annually killed, while the loss of lambs runs into thousands.

In my opinion the greatest pests sheepowners have to contend with are Blowflies, Dingoes, Foxes, and Crows. Very many useful birds are robbed of their eggs and young by the Raven. Bushmen, as a rule, hate the black fiend, but we read of some of the early explorers not disdaining a Crow stew when provisions ran short. Personally, I would go very close to starvation before tackling the Raven,

THE BIRDS OF THE COBBORA DISTRICT.

By THOMAS P. AUSTIN.

MOST of my observations of bird life have been within the boundaries of the Cobborah Estate, which is a grazing property of about eight thousand acres, through the middle of which runs the Talbragar River. Upon this Estate, on each side of the river, there are some very rich flats; after leaving these flats the nature of the country suddenly changes, it rather abruptly rises to a height averaging about fifty feet, then it is mostly sandy country, or ironstone ridges and hills, running back for many miles. Just at the western boundary of the Estate there is another change in the country. Here, on the north side of the river, rough, wild sandstone hills rise up very suddenly to a height of about three hundred feet; then on for forty miles the country is very poor, and has never been occupied. It consists of rocky ridges, either of sandstone or ironstone, one after the other, with poor sandy flats between. Practically the whole of this country is very heavily timbered, mostly with fine large ironbarks, from which hundreds of sleepers have been cut during the last two years. Beneath these trees the ground is mostly covered with thick scrub and undergrowth of various kinds; in some parts it is almost smothered with young pines; in others wattles, bullions, blackheath, stringybark saplings, and other kind of eucalyptus seedlings and suckers, which have sprung up after bush fires. Through the greater part of this vast forest one could travel for miles without seeing a drop of water, and very few birds; but just outside the western boundary of the Estate in this great forest there are a few small patches of country, which in a good spring are simply alive with birds. Further than these I seldom go, so my collecting area consists of about nine thousand acres, within the boundaries of which I have taken the eggs of one hundred and twenty-two species, and there are another ten I have known to breed here, although I have not actually taken their eggs.* I have identified another sixty species, but know nothing about any of them ever having bred in the district, most of them being just casual visitors. The timber on the Estate has been mostly killed, just sufficient being left growing to provide plenty of shelter for the stock. Along the river there are many fine large red gums and river oaks, most of the flats being lightly timbered with white and yellow box and native apple trees. Away from the flats the timber is similar, with the addition of a few pines and ironbarks in places, and most of the killed trees have been left standing. The following are the species of which I have taken the eggs, and a few remarks about them:—

†*Dromæus novae-hollandiae* (Emu).—I am glad to be able to say that a fair number of these stately birds are still to be seen here. They do no damage, and are given every encouragement to remain upon the Estate, but the scrubby ridges appear to be their stronghold, their visits to the Estate being mostly during times of drought. During the winter of 1915, when the country was suffering from want of rain, two broods were reared on the Estate, and in 1916 several nests containing eggs were found outside.

Lipoa ocellata (Mallee Fowl).—I regret to say that this fine bird has now entirely disappeared from the district. About ten years ago I found one of their nesting mounds in course of construction. When the birds appeared to have finished laying I completely enclosed it with wire netting, hoping to secure the young birds, but owing to the parents not being able to get at the mound the top set hard with the rain, and although the eggs incubated the young birds could not work their way out, and died in the shell, as I found when I opened the nesting mound just too late.

**Coturnix pectoralis* (Stubble Quail).—At the time I started to write this paper I had never seen a nest of this species, but on November 19th, 1917, while driving up to a sheepyard in a motor car on the Estate a bird flushed from almost beneath the car. Upon making a search I found a nest containing six eggs, the wheel of the car having passed over the edge of the nest and within two inches of the eggs. I left the eggs, but upon passing the nest some days later found the clutch had not been

* These species are marked with an asterisk.

† The nomenclature is that of Gregory Mathews's Hand-list of 1908.

increased, and the eggs were quite cold. When I came to this district first, 17 years ago, I often saw young birds while cutting the crops, but from 1905 till 1915 I did not see two dozen birds. During that period we did not once have a good spring, but this year and last year have been the two best I have known here, and there are a fair number of Stubble Quail about, and I have seen several broods of their young.

**Synoecus australis* (Brown Quail).—A rather rare species here; only a few coveys of them are found on the Estate, mostly along the banks of the river, where I have seen young birds.

Turnix varia (Painted Quail).—The first time I actually identified this species as being found in this district was on June 22nd, 1917, when I shot a pair. Since then they have been very numerous in suitable country, both on the Estate and out on the scrubby ridges. My dogs have found a great number of young birds, more especially when only a few days out of the shell, but strange to say I have only seen one nest containing eggs. They evidently have a long breeding season, and start very early. I caught young birds almost able to fly in August, 1917, and they were still breeding in November, because I saw very young birds on the 13th of that month.

Turnix velox (Little Quail).—Being a nomadic species, it only puts in an appearance here in good seasons, arriving sometimes in great numbers early in the spring, but they are all gone again by the end of March. They are late breeders. I have seen neither eggs nor young birds before November. One habit they sometimes have here when nesting, which I have not seen recorded before, is building a very substantial dome-shaped nest, and placed under the side of a small fallen dead tree trunk, somewhat resembling a roughly made nest of the Little Field Wren. The eggs are scarcely visible viewed directly from above.

Geopelia placida (Peaceful Dove).—A permanent resident, but some years much more numerous than others, more especially so in the spring. I have never seen them in such great numbers as during the spring of 1917. I have found them breeding from early in September till the middle of January, and their nests have been placed from six to sixty feet from the ground.

Geopelia cuneata (Little Turtle Dove).—I first saw this species here on 1st October, 1917; since then they have been rather plentiful, but only in the thickly-timbered country. I have only found one nest, which was placed in a stringybark sapling, about five feet from the ground, and although the eggs were in a very advanced state of incubation the sitting bird was very shy, and I had to hide in a bush near the nesting tree awaiting the return of the bird to enable me to get close enough to identify the species. This seemed rather strange, because when not nesting they are very tame.

Phaps chalcoptera (Bronzewing Pigeon).—A permanent resident, but like many other species found here it is much more numerous some years than others. During the summer they come to the river and waterholes to drink every evening about sunset, or even much later. They are very erratic in their breeding habits. I have found their nests from within a few feet from the ground to over sixty feet up, and have taken their eggs from the first week in September to the first week in March. As an edible bird in this district they are scarcely worth shooting. They mostly feed upon the wattle seeds, which appear to make them very tough and give them rather a disagreeable flavour.

Hypotaenidia philippensis (Pectoral Rail).—A very rare bird in this district. I have only known them to breed here upon two occasions; one nest with five eggs was found while cutting a crop; another pair bred at a dam only about a hundred yards from my house, where they reared their young. When first hatched they were clothed in black down, and had the habit of bobbing their tails, like some of the Water Hens.

**Poranza palustris* (Little Crake).—A very rare species here, but a few of them turned up during the winter of 1913, and bred at a lagoon just in front of my woolshed, but I did not know they were there until they had finished breeding. I then found several of their nests from which the young had lately gone, pieces of eggshells being in the nests.

Microtribonyx ventralis (Black-tailed Native Hen).—A very rare species in these parts, but about a dozen birds put in an appearance during the winter of 1909, taking up their abode at a dam near my house, and started nesting almost immediately. I took ten clutches of their eggs, and they laid from two to eight eggs for a sitting. They place their nests in a great variety of situations; some were in tussocks growing in water, others in the water roots of willow trees, some a few feet from the ground in the first fork of pepper trees, but one was placed in a most extraordinary position ten feet above the water in a white box tree. With the exception of two of these birds, they all departed before the end of the year. Although the two remained for several years they did not breed again; then one disappeared. The other is here still, having remained at the house dam for eight years, and I can hear it calling at the time of writing.

Podiceps novae-hollandiae (Black-throated Grebe).—After heavy rains which fill the lagoons these birds put in an appearance almost immediately. Upon one occasion there was a very heavy thunderstorm about five o'clock in the evening; it filled a swamp which had been dry for many months, and as it was the break-up of a protracted drought there had not been sufficient suitable water anywhere in the district for these birds, but when passing the swamp early next morning I was surprised to see about a dozen Black-throated Grebe upon the water. In suitable seasons they breed here freely, and I have seen their nests containing eggs from the first week in September to the end of January. Some years the Ravens find them out and destroy all their eggs, in spite of the birds covering them with water weeds before leaving the nests.

Lobivanellus lobatus (Spur-winged Plover).—A permanent resident, but in some years seen in rather large flocks, while in others only a few scattered pairs are to be met with. Their coming in great numbers is not owing to good seasons, because I have seen them here in large flocks during droughts. Their favourite haunts are near shallow swamps and open paddocks with short grass. They are extremely wary birds, being very difficult to approach. When darting down over water they rank amongst the fastest flying of Australian birds. They breed here very freely, and when disturbed from the nest they will not return while the intruder is in sight. Their eggs are very difficult to find without hiding and watching the sitting bird until it returns to the nest, which is usually much more substantially constructed here than those I have seen in other districts. I have never seen more than four eggs for a sitting, and they show considerable variation in shape, colour and markings. They mostly commence to lay about the middle of July and finish about the end of September, and unless their eggs or young are lost they only rear one brood in a season. On November 25th, 1909, I found a nest with the eggs just hatching, this being the latest which has come under my notice.

Zonifer tricolor (Black-breasted Plover).—Some years they arrive in large flocks in January, mostly immature birds, and during the heat of the day are to be met with beneath shady trees, usually at no great distance from water. In cool weather they scatter about the more open paddocks and plains. A few of them always remain to breed here. They are very solicitous for their eggs and young. If disturbed from their nest they will soon return, in spite of an intruder being only a short distance away and clearly in sight. They generally lay four eggs for a sitting, most of which show very little variation. I have found their nests containing eggs from the last week in May up till November 12th. If the material is available their nest is invariably placed amongst horse-dung. There is always a nest built, though in some cases it is very scanty, but I have never seen the eggs on bare ground.

Ægialitis melanops (Black-fronted Dotterel).—Always found here in great numbers, no matter what the season may be. After the breeding is finished they sometimes gather together in great numbers, usually about a dam in which the water has receded considerably, leaving broad, bare, muddy margins; but they are mostly met with in pairs or single birds, and usually in the vicinity of water. They place their nests, if such they can be called, in a great variety of situations, but usually it is a mere depression in gravel or sand. Like many other species, when disturbed from their nest, they adopt the habit of pretending to be crippled. On 16th November, 1917, I saw the best instance of this which has ever come under my notice. I suddenly came upon a sitting bird; it jumped up from the eggs as if trying to fly, but fell over backwards, exactly like a bird with a joint off one wing. I

watched it do it about a dozen times, and it was each time done so cleverly that I really thought the bird was a cripple, but upon making a nearer approach it flew away. I find they just as often lay three eggs as two, but I have never found more than three for a sitting, and I have taken their eggs from the 1st October up till January 13th.

Burhinus grallarius (Stone Plover).—About eight or ten years ago they were very numerous throughout the district; since then I notice that they are getting less and less each year, and it is seldom I ever hear one now. I can only put the decrease down to the increase of the fox. The young of this bird becomes such an easy prey for this pest. Their eggs in this district show very little variation, and I have found them from September 12th till December 10th.

Notophox novae-hollandiae (White-fronted Heron).—Never to be seen in great numbers here, but there are always a few about. They are usually to be met with in pairs or single birds feeding in the vicinity of water. For nesting purposes they generally resort to redgum trees overhanging water, often returning to the same nest year after year. The clutch is mostly from three to five, and I have found nests containing eggs from September 11th till November 21st.

**Notophox pacifica* (Pacific Heron).—A very rare species here; only small flocks of about half a dozen and single birds suddenly put in an appearance after big falls of rain, which fill the swamps and lagoons. I have only known of one nest here, which had young birds standing upon it when I found it.

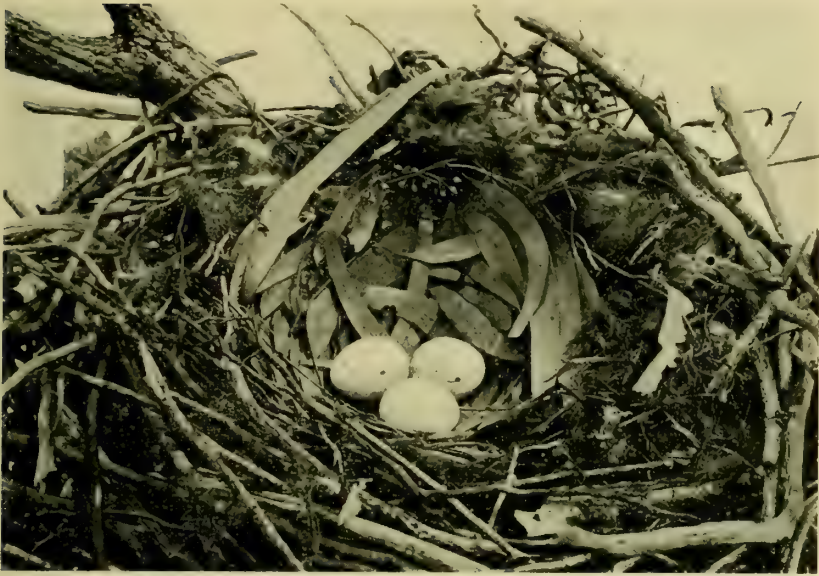
Chenonetta jubata (Wood Duck).—At times they are here in large numbers, but usually in small flocks of from four to a dozen birds, mostly met with feeding upon short green grass near water, such as the margin of a river, dams, lagoons, etc., and when disturbed they will often only fly a short distance, and settle upon a dead tree. They breed here more freely than any other species of Duck, usually going some little distance away from water to select a nesting tree with a suitable hollow. Although I see several broods of their young each year, I seldom find their nests, but I have taken their eggs from July 27th till September 11th, the largest clutch being ten eggs; but I have a set of fifteen in my collection, taken in the Riverina.

Anas superciliosa (Black Duck).—It is very rarely impossible to find a few of these fine birds on the Estate, but at no time are they in very great numbers. They are mostly met with in pairs or small flocks along the river. Nearly every year a few of them breed here, generally hatching their eggs in hollows in river redgums; only once in this district have I seen their nest upon the ground. Their breeding is governed by the season. I have seen young birds just hatched from the middle of June till the end of the year, but I have only seen eggs during August and September, the largest clutch being twelve.

Nettion castaneum (Chestnut-breasted Teal).—A very rare bird here. During my seventeen years' residence in this district I have only seen two pairs; the first put in an appearance during May, 1913, and I took their eggs, a clutch of nine, on July 26th. Another pair were on the Estate on 17th November, 1917, the female having a green head. Although I have seen a fair number of these birds in Victoria and Tasmania, this is the only time I have noticed a female in this stage of plumage.

Nettion gibberifrons (Grey Teal).—A rather common species here in suitable seasons, sometimes arriving in large flocks. Unlike the Black Duck, they are seldom seen upon the river; they appear to prefer dams, swamps and lagoons. They seldom breed here, but I have seen several nests containing eggs, all of which have been in hollows in redgum trees overhanging water, twelve eggs being the largest clutch. I have also seen a few broods of young birds.

Astur fasciatus (Goshawk).—Not by any means a common species. Occasionally a bird puts in an appearance, but they very seldom breed here. During 1906 I found a nest with young; the birds returned and bred in the nest again the following year. They laid and hatched while I was away in North Queensland. I have only taken two sets of their eggs in this district.



Nest and eggs of the Sparrow Hawk (*Accipiter cirrhocephalus*) in branch of a Native Apple Tree.

All illustrations are from photographs taken by the Author on the Cobborah Estate.

Accipiter cirrhocephalus (Sparrow Hawk).—A rare species here, just an occasional pair or a single bird turning up at any time. I have only found four nests; one had young when I climbed to it. I took eggs from the others, one nest two years in succession; upon the latter occasion the bird laid five eggs, which is the only clutch of more than four I have ever heard of. Most of the eggs taken here have been practically white, just an odd specimen being spotted, and then most of the markings as if beneath the surface of the shell.

Uroaëtus audax (Wedge-tailed Eagle).—This fine eagle is never very plentiful here, but there are always a few pairs about, and in this district they seldom, if ever, do any damage to the stock. In this district alone I have taken six sets of their eggs, and have climbed to at least an equal number of their nests containing young birds, and numerous others from which the young have gone. Although they breed in the lambing season, I have never yet seen the remains of a lamb in the nest, but always rabbits, and plenty of them. They are early breeders, sometimes laying in May, but mostly in July.

Eutolmæus morphnoides (Little Eagle).—A very rare bird here. I have only seen four pairs, and they were all breeding, the first being in 1910, and as I was not sure of the species I shot both birds at the nest. The following year another pair came and built a nest in a tree only about 150 yards away from where the first nest was. It contained a nearly fully-fledged young bird when I found it. I saw no more of this species until 1917, when another pair had a nest only about 150 yards from No. 2, and another pair built a nest a few miles down the river. Of the three sets of eggs only one has been a pair, the others being single eggs, and they were taken during the months of September, October and November.



Nest and eggs of the Little Eagle (*Eutolmætus morphnoides*) (originally the nest of a Raven (*Corone australis*)) in branch of a river Red Gum.

Haliastur sphenurus (Whistling Eagle).—Before I eradicated the rabbits on the Estate these birds were present in great numbers, and I used to take about thirty clutches of their eggs every year. As soon as I got rid of the rabbits these Eagles mostly disappeared, and now I only see on an average about one nest a year. They are very erratic in their breeding habits; I have taken their eggs during every month of the year with the exception of January and February. Two eggs are usually the full clutch; but of one hundred and eight nests I have examined containing eggs, thirteen contained sets of three. I have never seen a larger clutch, and only once have I seen three young birds in a nest.

Falco lunulatus (Little Falcon).—A very rare species here, just occasionally a pair or a single bird putting in an appearance at any time of the year. I have only known them to breed here once; the nest was placed near the top of a very lofty river redgum tree, from which I scooped three fresh eggs on October 9th, 1912.

Hieracidea orientalis (Brown Hawk).—During the years 1908, 1909, 1910 and 1912 these birds were very common here, and I took seventeen sets of their eggs. Since then I have not known them to breed here till 1917, when I found two nests; in fact, the birds are seldom seen here now. They generally use an old Raven's nest; only once have I known them to build a nest for themselves. The clutch is generally three; I have never taken more. I have examined nests containing eggs from the middle of August till November 11th. They do no harm. I have not even known them to kill a bird of another species.

Cerchneis cenchroides (Kestrel).—Frequently met with at any time of the year. They are quite harmless; in fact, I consider they do a lot of good by destroying such pests as grasshoppers and mice. They are rather late breeders; of twenty-five clutches of eggs I have taken all were

found during the last three months of the year, and they usually lay from three to five eggs, which show considerable variations in the markings. I have never found them nesting in any place other than in the hollow of a tree.

Ninox boobook (Boobook Owl).—Considering the class of country it is strange that this species is not more numerous here; but owing to their nocturnal habits they might be more plentiful than they appear to be. I have only taken three clutches of their eggs, all of which were found during the month of October.

Ninox connivens (Winking Owl).—There are always a few pairs to be found on the Estate. Once they take up their abode in any particular locality they remain about there for years, sometimes nesting in the same hollow season after season. They are early breeders, often having young by the middle of August, but I have taken their eggs as late as November 16th; this, however, might have been a second laying. They usually lay three eggs for a sitting, often only two. I have taken ten sets of their eggs, and found a number of their nesting hollows containing young birds. Their usual call note cannot be distinguished from that of *Ninox boobook*, but when disturbed at their nest and perched in a neighbouring tree they have quite a different note, somewhat resembling a loud screeching growl.

Strix delicatula (Delicate Owl).—From the number of dead birds I have found upon this estate this species at one time must have been rather plentiful; but for the last seven years I have not seen one, dead or alive, and I think they are now quite extinct as far as this district is concerned. I have only once found a nesting place, which contained three eggs.

Glossopsittacus concinnus (Musk Lorikeet).—Some years, usually in the early summer, when the eucalyptus trees are in bloom, these birds arrive in thousands, most of them departing again before the winter. Usually a fair number of them remain throughout the year, and some seasons breed here freely, commencing towards the end of July, but I have taken eggs as late as the middle of October. I have examined about forty nesting hollows containing eggs or young, but have never seen more than a clutch of two. When sitting the bird becomes very tame. I have repeatedly seen them come and perch within a few feet of me while I have been chopping out their nesting hollow.

Glossopsittacus pusillus (Little Lorikeet).—Rather a common species on the Estate, some years arriving and feeding with *G. concinnus*, though never in such great numbers, but they are more often met with in pairs. They are very tame, showing little fear of man. When feeding they will often allow of a very close approach, giving an intruder the impression that he had not been observed. They nest here freely, but owing to being very close sitters their nests are most difficult to find, and few would ever be discovered containing eggs only for two peculiar habits of the birds. One is, the non-sitting bird usually remains near the nesting tree, and if watched for a few minutes invariably flies to the entrance of the nesting hollow. The other is, the sitting bird will often leave the nest and take a rapid flight, often with the mate, high up in the air, uttering a peculiar screeching note, suddenly darting back to the nest. I have often chopped open their nesting hollows and had to pull the sitting bird off the eggs. The clutch is usually four or five; I have never seen more. They are early breeders, commencing towards the end of July, but I have taken fresh eggs as late as the middle of October, which was probably a second laying.

**Calyptorhynchus viridis* (Leach Cockatoo).—There are always a fair number of them in the ranges, usually keeping to the dense ironbark forests. I have known of their nests to be found in the district, and I have seen young birds, but I have never been able to find a nest myself. They are exceptionally tame, showing little fear of man. I have often ridden beneath a tree containing a flock of them, and there sat and watched them. I once saw six on top of a large dead ironbark tree, amongst them a beautifully yellow-mottled bird. This one I shot with a revolver; the other five did not appear to take the slightest notice of the shot, not even flying from the tree.

Cacatua galerita (White Cockatoo).—Rather a rare species here, being more numerous about twenty miles down the river. But if I have a ripening maize crop these birds are sure to find it out,

and a flock of about fifty will do great damage to it in a few days. I have only taken three sets of their eggs, and climbed to three other nests containing young birds. They lay from two to three eggs during the months of September and October, but in my collection I have a clutch of four taken in Queensland.

Calopsittacus novae-hollandiae (Cockatoo Parrakeet).—The arrival and departure of this species is very erratic; sometimes large flocks of them will suddenly put in an appearance, only to disappear again within a few days, while other seasons they will remain throughout the year and breed here. Their nests containing eggs are rather difficult to find. I have only taken their eggs twice, both of which were clutches of four, but I have known of larger broods of young birds.

**Ptilotes erythropterus* (Crimson-winged Lory).—Extremely rare in this district; I have only seen three birds, but I know of one nest having been found.

Platycercus eximius (Rosella).—A very common species on the Estate and a great nuisance in the orchard while the fruit is ripe, destroying great numbers of quinces, peaches and pears. They breed here freely, mostly laying during October, and the clutch is generally from six to eight for a sitting. I have never taken more than the latter number.

Barnardius barnardi (Mallee Parrakeet).—A rare species here, only met with in pairs or small flocks of from four to half a dozen birds. I have only found one nest which contained five eggs.

**Psephotus haematorrhous* (Crimson-bellied Parrakeet).—A very rare species here, but not many miles away they are very common. I have only known of one nest in this district from which young birds were taken and reared. Their nests are very difficult to find; it is almost impossible to flush a sitting female from the hollow, but she always comes out towards evening to be fed by the male, and to watch for her appearance is the only way to find a nest containing eggs.

Psephotus haematonotus (Red-backed Parrakeet).—One of the most common birds of the district. They are to be met with in pairs or small flocks anywhere in the more open country, but sometimes during the winter they congregate in large flocks. Later on during the early part of the breeding season it is no uncommon thing to see a number of males together, forming a sort of bachelors' club. When nesting they become very quarrelsome, fighting with any others that happen to enter the tree containing the nesting hollow. The female solely performs the task of incubation, but is fed by the male, for which purpose she leaves the nest, and keeps up a peculiar chattering noise while being fed, similar to young birds. They breed here very freely, usually commencing during September, and most of the nests contain young birds by the end of October. I have examined a great many of their nests, some of which have been in low hollow stumps, the eggs resting upon the ground, while others have been in hollows in trees as much as sixty feet from the ground. They usually lay from four to six eggs for a sitting, but I have taken clutches of seven and eight.

Melopsittacus undulatus (Warbling Grass Parrakeet).—Some years they appear here in the spring when the grass seeds are ripening, in flocks of thousands. They soon commence to pair off and breed, often using a tiny hollow, so small within that it is impossible for them to rear their whole brood, consequently many of the young birds are smothered in the nests as they increase in size. Some years they breed very late, practically all of them laying in December, but I have never found eggs here before the middle of November. They lay from five to seven eggs, but appear to differ from most birds in the time they take to lay the whole clutch. In sets of seven the first egg laid is almost hatched by the time the clutch is complete; therefore the eggs are in all stages of incubation, showing that there must be an interval of some days between the laying of each egg.

Podargus strigoides (Tawny Frogmouth).—A very rare species here. During my seventeen years' residence in this district I have only seen four pairs of them, all of which were breeding. On the morning of May 3rd, 1915, I found a freshly-killed bird in my garden; from the appearance of the ground and the numbers of feathers scattered about I think it had lost its life in a fight; it had not been destroyed by any animal, because the skin was not in any way damaged.

**Aegotheles novae-hollandiae* (Owlet Nightjar).—Owing to its habit of living during the day in hollows these birds are little seen, but I often hear them calling both during the night and day. I have found several of their nests containing young, and once flushed a sitting bird from a partly fallen-in old nest of a Red-backed Kingfisher, near the top of a high bank of the Talbragar River, the nest containing three eggs, which I left to hatch. They are very tame little birds; I have several times known them to come into my house. On one occasion I was writing rather late on a hot night in my collection room, when one of these birds came in at the window and perched on the table in front of me. I just put out my hand and caught it, and even while in my hand the bird did not show the slightest sign of fear, so I put it out of the window again. I had a similar experience with another which I caught in my bathroom early one morning.

Eurystomus pacificus (Dollar Bird).—A few pairs arrive here every year in October, and mostly take up their abode about the same locality year after year, which is mostly in the large redgums growing on the banks of the river. I have never known them to breed a second time within the same hollow; they choose a fresh one each season, and it is generally high up. Four eggs form a complete clutch for a sitting, but often only three are laid. The eggs are not always pure white; I have found them pronouncedly spotted, but the markings appearing as if beneath the surface of the shell. Most of the birds lay in November, and as soon as the young birds are strong enough they all take their departure.

Dacelo gigas (Brown Kingfisher).—A very common bird throughout the whole district, mostly met with in pairs or small communities. They breed here in great numbers, choosing hollows in trees at various heights from the ground, sometimes quite low down, while others are as much as seventy feet from the ground. The clutch is usually three, but I once climbed to a nest containing four young birds. They are rather late breeders, most of them laying in October, but I once took a set of slightly incubated eggs on the 16th December.

Halcyon pyrrhopygius (Red-backed Kingfisher).—A few pairs arrive here every year during the months of October and November, and usually take up their abode in ring-barked country, resorting to the banks of dry creeks for nesting purposes. No matter how hard the clay may be they appear to have no difficulty in drilling a tunnel into it. They are very close sitters; I have often caught them in their nests. They breed here very late; I have taken eggs from the last week in October up till January 10th, and they mostly lay four or five eggs. I have never taken more than the latter number.

Halcyon sanctus (Sacred Kingfisher).—They arrive here every spring, but never in very great numbers, and excepting when with young I have never seen more than two birds together, but pairs are dispersed throughout the whole district, mostly within the vicinity of water. The nest is usually within the hollow branch of a tree, but I have found them drilled into the soft sandy soil near the top of a bank. They often betray the whereabouts of their nest by uttering loud, screeching cries. They are late breeders, all the eggs being taken during November, and the clutches were all four or five.

Merops ornatus (Bee Eater).—Arriving here in large numbers during October, they have all departed again by the end of March. Although I have found many of their nesting burrows, I have never seen one drilled into a bank; here they have all been in flat sandy country, but sometimes on the side of a deserted rabbit burrow. They breed late, most of them having eggs during November and December, and a full clutch is nearly always five. I have never seen a larger one.

Eurostopus albigularis (White-throated Nightjar).—A species which is very seldom seen during the day, but while fishing in the river just after sundown I see a fair number of them. They drink while on the wing in the same manner as Swallows. I have only found their nesting place twice—once with a young bird, the other containing an egg; that was on October 28th, 1910, both nests being simply the bare ground amongst stones and eucalyptus leaves.



Nesting place and egg of the Spotted Nightjar (*Eurostopus argus*).

Eurostopus argus (Spotted Nightjar).—Until October 28th, 1915, I had not identified this species as being found in this district. I had just returned from Tasmania, and one of my employees, who had been ringbarking during my absence, told me of a nest he had found containing a single "blue" egg amongst stones. From his description I could not think what species it could be, so thought it best to go out with him and see for myself; but I firstly asked him if he thought the egg would be now hatched. He informed me that he knew it had not, because he saw it the previous day, and also, a week ago, he put the egg in a pint of cold water from his water-bag first thing in the morning, leaving it there all day, returning it to the nest just before he came home in the evening, and that the bird had gone back to it and was still sitting. When I arrived at the place there was the Spotted Nightjar on the egg, which was just on the point of hatching; the shell was chipped, and the young bird was chirping. So the incubation of the egg had not been interrupted by being placed in cold water for a day. This shows that the cold has little effect upon these eggs—probably one of Nature's protections to enable the bird to leave its egg at night to feed. There was no nest built, the egg being just simply laid amongst stones, and it was a typical one, not "blue."

Cuculus inornatus (Pallid Cuckoo).—They generally begin to arrive about the end of August, sometimes earlier, but I have never known them to remain here through the winter; they have all departed before the end of March. There are not a great many of them, or, in fact, any species of Cuckoo, breeding in this district; but I have found their eggs in nests of the following species:—Brown-headed Honey-eater (*Melithreptus brevirostris*), White-plumed-Honey-eater (*Ptilotis penicillata*), White-eared Honey-eater (*Ptilotis leucotis*), Regent Honey-eater (*Meliphaga phrygia*), and Yellow-faced Honey-eater (*Ptilotis chrysotis*), and I have seen young birds being fed by Noisy Miners (*Myzantha garrula*) and Rufous-breasted Thickheads (*Pachycephala rufiventris*). I have taken their eggs from the 23rd August up till 17th November.



Nest and eggs of the Warty-faced Honey-eater (*Meliphaga phrygia*) with an egg of the Pallid Cuckoo (*Cuculus inornatus*).

Cacomantis rufulus (Fantail Cuckoo).—Some years this species does not put in an appearance here at all, while in others it is fairly numerous, generally met with in the more thickly timbered country. Only once have I found it breeding here; an egg was placed in a nest of the Little Field Wren (*Chthonicola sagittata*).

Mesocallius palliolatus (Black-eared Cuckoo).—A bird which, owing to its habits, and also to its similarity in appearance to a female *Lalage tricolor*, it easily escapes notice. The first proof that I had of it being in the district was its egg being brought to me by a boy, taken with two eggs of the Little Field Wren (*Chthonicola sagittata*). Since then I have often seen the birds, and shot a few for identification, and I have twice taken an egg, each time in a nest of the Little Field Wren.

Chalcococcyx basalix (Narrow-billed Bronze Cuckoo).—Every year a fair number are to be seen in the spring. I have taken their eggs from nests of the following species:—Red-capped Robin (*Petroeca goodenovii*), Buff-rumped Tit (*Acanthiza reguloides*), White-browed Babbler (*Pomatorhinus superciliosus*), and Silvery Blue Wren (*Malurus cyanoclamys*). With regard to the latter, I took the first set with Mr. A. F. Basset Hull on the 1st October, 1917, the Cuckoo's egg being covered by the lining of the nest. Eleven days later she had built another nest and laid two eggs, and it also contained one of the Cuckoo. On November 2nd, 1917, she had another nest built and two eggs, and again one of the Cuckoo was deposited in the nest. In the two latter cases the Cuckoo's egg was not covered. All the nests were built within a few yards of each other.

Chalcococcyx plagosus (Bronze Cuckoo).—This species arrives in the early spring, and I have only taken their eggs with the following species:—Yellow-rumped Tit (*Acanthiza chrysorrhoa*), Buff-rumped Tit (*A. reguloides*), and Red-rumped Tit (*A. pyrrhopygia*).

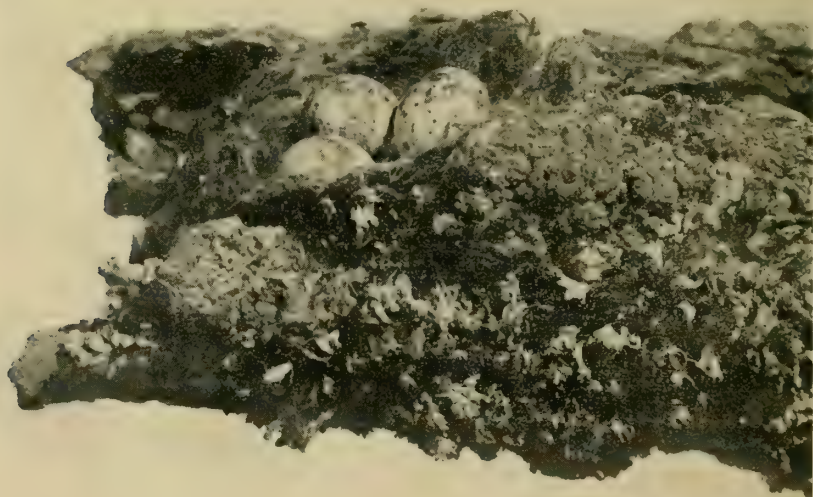
Hirundo neoxena (House Swallow).—A few pairs sometimes remain about my house the whole year, and return to the same nests season after season, often rearing three broods one after the other. Most of their nests are placed on rafters in outbuildings, such as stables. A few years ago one pair started to build in a passage in my house, and although the nest was knocked down day after day they would not give up building, so I kept the doors shut for about a week, but as soon as they were left open again the Swallows returned. I then hung a stuffed Goshawk just beneath the nest; this was too much for the Swallows, so they went under a back verandah, built a nest, and reared their young.

Cheramoeca leucosternum (Black and White Swallow).—A few years ago this species was frequently seen at any time of the year, but I have not seen any since 1911. They used to nest here in holes drilled into the banks of the river and dry creeks, laying from three to six eggs.

Petrochelidon nigricans (Tree Martin).—A very common species, remaining throughout the year. Often several pairs of birds will be found nesting in the same tree, sometimes in the same branch, and I have found more than one nest within the same hollow. They are very close sitters; I have frequently chopped open the nesting branch and lifted the sitting bird from the nest. They usually lay during September and October, but generally rear a second brood. Four or five eggs are mostly laid for a sitting.

Petrochelidon ariel (Fairy Martin).—Arriving in large numbers towards the end of August and early in September, they commence nest building almost immediately, often resorting to the same place year after year. They do not all appear to arrive at the same time. I have frequently found almost fully-fledged young birds, while other nests in the same colony are not half completed. Fresh eggs may be found as late as December, but no doubt this is often owing to birds laying a second time. They lay from three to five eggs for a sitting, a big percentage of which are pure white without any markings, while others are heavily freckled, especially about the larger end.

Microeca fascians (Brown Fly-catcher).—This cheerful little bird remains here in great numbers throughout the year, and is met with almost anywhere, mostly in pairs. Their small nests would generally escape notice if it were not for the solicitous actions of the owners. They mostly lay during September and October, but nests containing eggs are at times found much later, probably second layings. Two eggs are mostly laid for a sitting, but I have twice found clutches of three.



Nest and eggs of the Red-capped Robin (*Petroeca goodenovii*), about natural size, in partly broken piece of bark of a dead Ironbark Tree.

Petroeca goodenovii (Red-capped Robin).—Always to be found in great numbers in the drier tracts of the district. Commencing in August, they breed here freely, rearing two broods in a season. The clutch is just as often two as three; I have never seen more than the latter number. They often become the foster parents of the Narrow-billed Bronze Cuckoo.

Petroeca bicolor (Hooded Robin).—Generally dispersed in pairs throughout the more open country; mostly found near the ground perched on dead branches. I have never met with this bird in the heavily timbered country. The female alone builds the nest, and takes upon herself the whole task of incubation. They are very close sitters, often allowing an intruder to approach within a few yards before leaving the nest. Breeding here freely, usually placing their nests low down, I have examined a great many of them containing both eggs and young birds, but have never seen more than two to a clutch. Eggs may be found during the months of September, October and November.



Hooded Robin (*Petroeca bicolor*) on nest in a White Box sapling.

Smicromis brevirostris (Short-billed Tree Tit).—Numerous in the country where the eucalyptus saplings are growing; seldom seen high up in large trees. They breed here freely, placing their nests in the leaves of drooping willow-like branches of eucalyptus trees, generally near the ground, and most of those I have found have been discovered by the sitting bird flushing as I rode past. They usually lay three eggs. I have taken them at all times between August 25th and December 10th, and although I have examined a great many of their nests I have never known a Cuckoo to place its egg in any one of them.

Gerygone albigularis (White-throated Fly-eater).—Some years during the spring and summer months they are very common, while in other years not a bird is to be seen. Their notes and habits are very similar to those of *Pseudogerygone culicivora*, and their nests can only be distinguished by the colour, the present species using the inner reddish bark of the stringybark trees for an outer

covering, while the nest of *P. culicivora* is always constructed of greyish material. They usually lay three eggs for a sitting, and about a dozen nests I have examined containing eggs were all found between October 22nd and November 27th.

Pseudogerygone culicivora (Western Fly-eater).—Always met with in pairs. Some years during the spring and summer months they are rather plentiful, but they do not remain here during the winter. Breeding here freely, their nests are usually placed low down, often within a few feet of the ground, and as I have mentioned in my notes of the preceding species, their nests can always be distinguished from each other by the colour. They are generally decorated with bits of newspaper if available, or whitish egg-bags of spiders, and some nests have exceptionally long tails. Although I have examined a great number of their nests, I have never found one containing an egg of a Cuckoo. They mostly lay three eggs for a sitting, which show considerable variation in the markings. I have taken their eggs from September 23rd till as late as December 3rd.



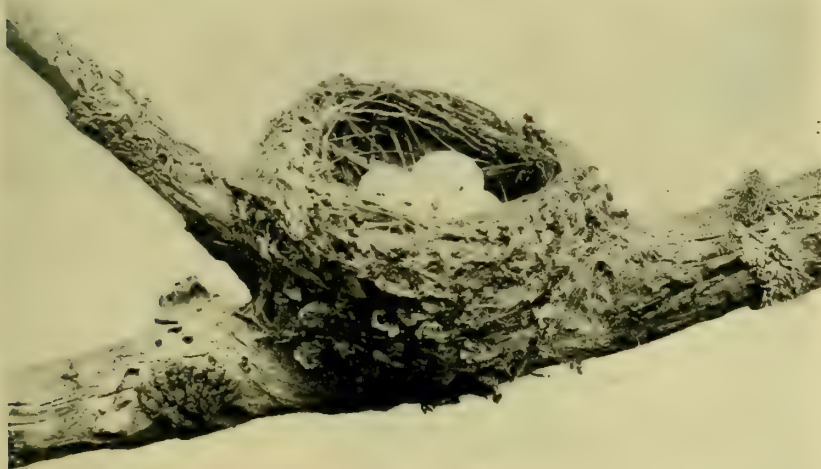
Nest of the Western Fly-eater (*Pseudogerygone culicivora*).

Rhipidura albiscapa (White-shafted Fantail).—Rather a common species in suitable country, more especially during the spring and summer; generally met with in pairs, often returning to the same locality year after year. They breed here, but owing to the birds being exceptionally close sitters, and also the nest being usually placed in a whitegum sapling, the branches of which are so much the same colour as the nest, it is very difficult to find. I have put my hand within a few inches of a sitting bird before it would leave the nest. They generally lay three eggs for a sitting in the month of October.

Rhipidura tricolor (Black and White Fantail).—Very common throughout the district, but being a lover of water it is more frequently met with in the vicinity of same, and it appears to have a friendship for the Magpie Lark, often building its nest in the same tree, but much lower down. They also very often take up their abode about dwellings; one pair have been about my house for many years, breeding in the grape vines growing on the verandah, where I have known them to rear

three broods in a season, building up the old nest time after time. They place their nests in a great variety of situations, but the most extraordinary which has come under my notice was one built on top of an old Swallow's nest on a rafter in a stable.

Myiagra rubecula (Leaden Flycatcher).—A rather rare species here, just an occasional pair turning up some years in the spring. I have seen several pairs building nests, all rather high up in large ironbark trees, but with one exception they all disappeared before the eggs were laid. The only eggs I have taken here were a clutch of three on November 12th, 1915.



Nest and eggs of the Leaden Flycatcher (*Myiagra rubecula*) on a dead branch of an Ironbark Tree.

Sisura inquieta (Restless Flycatcher).—A rather common species here at any time of the year, but they appear to be more numerous during the spring and summer months. Although sparingly dispersed throughout the district, they are more often met with near water. They are rather late breeders; most of the nests I have seen containing eggs have been during the months of October and November, and the clutch is generally four.

Pteropodocys phasianella (Ground Cuckoo Shrike).—There are always a few of these fine birds to be met with on the Estate, generally found feeding upon the ground in flocks of five, comprising a pair of old birds and their last brood of young, which often remain with their parents until another brood are upon the wing to take their place. I have four times found two pairs of these birds breeding together, twice actually laying in the same nest, each nest upon these occasions contained six eggs. In another case there were two nests built within a few feet of one another on the same branch, and young birds in each. The other which came under my notice was only about a hundred yards outside my garden. The old birds built in exactly the same fork in which they had reared their young the previous year, and the young birds built in an old Magpie Lark's nest in a neighbouring tree only a few yards away. They usually lay three eggs for a sitting, but I have found a clutch of four, and, as I have mentioned above, twice six, which was undoubtedly the result of two females

laying in the same nest. I have taken eggs from September 1st up till December 15th, which was a second laying, as I had already taken their eggs the same season. If not much disturbed they will often remain about the same locality for years, even breeding in the same tree season after season.



Nest and eggs of the Black-faced Cuckoo Shrike (*Coracina robusta*)
in branch of a Native Apple Tree.

Coracina robusta (Black-faced Cuckoo Shrike).—A very common species throughout the whole district, just as often met with in the open ringbarked country, where only a few shade trees have been left growing, as in the thick ironbark forests. After the breeding season they sometimes become a great nuisance in orchards, but more especially in vineyards, devouring large quantities of grapes. After flight, when perched, they have a peculiar habit of slightly lifting their wings, one after the other, several times, giving an observer the impression that the wings did not fit down comfortably on the body. They breed here very freely, usually laying three eggs for a sitting; I have never seen a larger clutch, and their eggs have a wonderful range of variation, it being difficult to find two sets alike. Of a great number of nests I have examined containing eggs, more than half of them have been during the month of October, but I have taken eggs as early as September 29th and as late as December 15th.

Lalage tricolor (White-shouldered Caterpillar-eater).—Never have I known this species to remain here during the winter. They arrive in large numbers some years during the spring, mostly in October, but odd birds may sometimes be seen towards the end of September. Some of the males are inclined to be pugnacious during the resting season, but this is not the general rule, because I have frequently found several pairs nesting in the same tree in perfect harmony. In fact, this nesting together seems to be a peculiarity with them; where one nest is found there are generally many of them, not always in the same tree, but near by in the same clump of trees. Both birds assist not only in building the nest, but also in the task of incubation. They are late breeders. I have never taken eggs before October 20th, but I have taken fresh eggs as late as December 20th.



Nest and eggs of the White-shouldered Caterpillar-eater (*Lalage tricolor*)
in a branch of a Yellow Box Tree.

Cinclosoma punctatum (Spotted Ground Bird).—Although this species might be more numerous than it appears to be, I am under the impression that it is far from common in any part of this district, but at the same time I have met with it sparingly dispersed in all parts where there is any undergrowth. I have only found one nest containing eggs, but have often come across young birds unable to fly.

**Hylacola pyrrhopygia* (Chestnut-rumped Ground Wren).—I had lived in this district over sixteen years without identifying this species, but on October 7th, 1916, I shot a fine old male and a pair of immature birds which had not been many days out of the nest. Since then I have seen three more pairs, but so far have not found a nest.

Pomatorhinus friolus (Babbler).—A very common bird on the Estate, and they breed here freely, but owing to their habit of building nests at any time during the year, many of which they never lay in, it is no uncommon thing to see several nests in the same tree and many others in close proximity, and as birds are often flushed from these dummy nests it is difficult to know when they are actually breeding. The peculiar song of this species is not all uttered by one bird, as many people suppose. I have often had the opportunity of watching them closely, and I find that the different notes come from two or more birds. In this district they rarely lay more than three eggs for a sitting; although I have several times taken clutches of five they usually appear to be the result of two females laying in the same nest. They breed early, mostly laying in August, but I have found eggs as late as November 11th.

Pomatorhinus superciliosus (White-browed Babbler).—For the first ten years I lived in this district I saw nothing of this species, but of late years a few have taken up their abode just outside the west boundary of the estate, and have built a great number of their nests there in dead wattles.

During the last two seasons I have taken half-a-dozen clutches of their eggs, all of which have been sets of three.

Cinchorhamphus cruralis (Brown Song Lark).—During the spring of 1916 and 1917, two of the best seasons for many years, these birds have been very numerous in the more open parts of the estate. Their nests are very difficult to find. The female takes upon herself the task of incubation, and is a very close sitter, so finding the nest is simply a matter of chance—one has almost to tread upon it before the sitting bird will flush. As a rule they breed late, often having fresh eggs in January, but on November 14th 1917, I found two nests, each containing three eggs in a very advanced state of incubation. I have never found more than three eggs for a sitting.

Cinchorhamphus rufescens (Rufous Song Lark).—In a favourable spring this species is very numerous on the estate, and although often found together with the Brown Song Lark, the present species has a preference for timbered country, more especially dead timber, where there are plenty of dead fallen branches upon the ground, beneath which they delight in building their nests, and they just as often lay three eggs as four for a sitting, mostly during November.

Ephthianura albirostris (White-fronted Chat).—A rather rare species here; small flocks may turn up at any time, but most of them seldom stay long, and very few of them breed here. I have only found half a dozen of their nests, each of which contained three eggs.

Ephthianura tricolor (Tricoloured Chat).—A few of these birds put in an appearance on an average about once every five years; they remain to breed, then disappear. They mostly lay three eggs for a sitting during November, but I once found a nest on October 19th containing two slightly incubated eggs.

Acrocephalus australis (Reed Warbler).—Some years this species does not put in an appearance at all; in other years they arrive during the spring in fair numbers, taking up their abode in any suitable situation. At the present time (1917) a single bird (as far as I can judge) has taken a fancy to my garden. This seems strange, because there is a large dam full of water with plenty of cover around it not a hundred yards away. They breed here rather late, the earliest date on which I have seen eggs being November 14th and the latest January 22nd.

Megalurùs gramineus (Grass Bird).—I have only seen one pair in this district; they arrived at my house dam about September 1st, 1912, and built a nest in a clump of bulrushes, from which I took three eggs. They almost immediately commenced another nest, and eventually laid another clutch of three.

Cethonicola sagittata (Little Field Wren).—Not by any means a common species anywhere in this district, but a few scattered pairs are to be met with in the more thickly timbered country. I have only found five of their nests, and only one of them was without an egg or young of a Cuckoo.

Acanthiza nana (Little Tit).—Being so small, and usually keeping rather high up in thickly foliated pine trees, these birds mostly escape notice, but I am sure they are not here in any great numbers. They are rather shy, and strongly object to any interference with their nest; when it is being constructed they will desert it for the least cause. I have found several nests by seeing the birds building, most of which have been torn to pieces upon my next visit to them. I have taken four sets of their eggs, all during the month of October.

Acanthiza pyrrhopygia (Red-rumped Tit).—A rather rare species, their range of habitation being very limited. I have found five of their nests containing eggs, in three of which the full clutch was a single egg; the other two contained each two incubated eggs, and I have also found two nests containing a single young bird. Their nests can always be distinguished from that of any other species I know of owing to a number of long streamers of thin blades of soft grass always hanging from just below the entrance,



Nest of the Red-rumped Tit (*Acanthiza pyrrhopygia*) in topmost branch of a small Ironbark sapling.

Acanthiza chrysorrhoa (Yellow-rumped Tit).—This well-known little bird is rather rare in this district, but there are always a few of them about my garden, where they breed every year, laying from three to four eggs for a sitting. Their nest is a favourite one for the Bronze Cuckoo to place its egg in. They never enter into the thickly timbered country in these parts, keeping to the open forests where there is little undergrowth.

Acanthiza reguloides (Buff-rumped Tit).—A very common species in just the very class of country which the Yellow-rumped Tit avoids. They are usually met with in small flocks feeding upon the ground between the scrubby bushes. They place their nests in a great variety of situations, and lay either three or four eggs for a sitting. All I have taken were found during the month of October.

Malurus cyaneochlamys (Silvery Blue Wren).—This is the only *Malurus* found in this district, and during the first ten years of my residence here I did not see a single bird, the first which came under my notice being on January 13th, 1910. They had a nest containing three eggs in a black thistle growing on the edge of a lagoon, only a few yards outside my woolshed. Since then they have been increasing, and now there are a fair number of them on the estate, but I have never found them them far away from water. One family have been breeding in my garden for the last five years, and at the present time have a nest in a clump of sweet peas only a few steps off my verandah, and I can see the nest while writing these notes. The female is sitting upon three eggs.

Artamus leucogaster (White-rumped Wood Swallow).—They do not put in appearance every year, but occasionally a few pairs arrive in the spring, always taking up their abode in the large red gums growing on the banks of the river, where they breed. Their nests are placed sometimes in a partly rotten hollow branch, or where a branch has been broken off, and very often in an old *Grallina's*

nest, lining it with fine dry grass or river oak needles. They usually lay four eggs for a sitting, mostly during the months of October and November.



Nest and eggs of the White-rumped Wood Swallow (*Artamus leucogaster*) in dead branch of a river Red Gum Tree.

Artamus superciliosus (White-browed Wood Swallow).—Some years arriving in thousands in the early part of the spring, while other years not a bird will be seen. They commence breeding almost immediately they arrive, mostly laying two eggs for a sitting, but often three. This year (1917) they arrived in great numbers during the second week in October, and were breeding everywhere, when suddenly something must have gone wrong, because nearly the whole lot rolled their eggs and young out of their nests, and practically all the birds disappeared. This all happened within three days, between November 8th and 11th.

Artamus personatus (Masked Wood Swallow).—Arriving with *Artamus superciliosus*, but never in anything like such great numbers. This year (1917) there were more of them breeding here than I have ever known before, but they treated their eggs and young in the same manner as the White-browed, described above.

Artamus tenebrosus (Wood Swallow).—A permanent resident, but never in great numbers; generally met with in pairs in the ringbarked country, where they breed. They place their nests in a great variety of situations, and usually lay three eggs. I have never found a larger number for a sitting, and I have taken their eggs from September 29th up till December 15th.

Collyriocichla harmonica (Grey Shrike Thrush).—This bird is met with in all classes of timbered country, but is more numerous in the ironbark ranges. In this district it is extremely shy; in habit it much resembles the Spotted Bower Bird. It is far more often heard than seen. When building, it is only necessary to ride close past their nest and they will leave it for ever. I have never yet found a nest in course of construction which was not immediately deserted. The situations chosen for nidification are very various: sometimes in a sapling, others in crevices in a bank of a dry creek.

but more often on the top of a slightly hollow burnt stump; and I have seen them from three to twenty-five feet from the ground. I have often seen young birds on the wing during September, but have only found nests containing eggs from September 12th up till November 13th, and the clutch is usually three.

Grallina picata (Magpie Lark).—A very common species throughout the district, anywhere in the vicinity of water. As a rule they breed here in great numbers, but for some unaccountable reason during the present year (1917) very few of them bred at all. I did not see half-a-dozen nests occupied. Most of the nests contain eggs during the latter part of September and October, but I have found fresh eggs as late as December 1st. Four eggs constitute the usual number for a sitting, but they often lay five, and they place their nests at various heights, some are to be seen quite low down, near the surface of the water, while others are as much as seventy feet above.

Gymnorhina tibicen (Black-backed Magpie).—Although this species is far from common anywhere in the district, scattered pairs and small flocks are to be met with in the more open forests, and ring-barked country. Once they take up their abode in any particular locality, they usually remain thereabouts for years, sometimes building a new nest in the same tree season after season, but they only rear one brood each year, and the young birds remain with their parents till the approach of the following breeding season. I have examined a great number of their nests, but have never seen one containing eggs earlier than August 22nd, and none later than October 24th. They mostly lay four eggs for a sitting. I have never found a larger clutch, and it is seldom that two clutches from different birds are found exactly alike in colour and markings.

Gymnorhina leuconota (White-backed Magpie).—A very rare species in this district, but one bird has been here to my knowledge for the last four years; it is mated with one of the black-backed birds, and they breed about the same place each season. I had one of their young, but when about a year old it was killed by a Goshawk. To all appearance it was purely a black-backed.

Cracticus nigrigularis (Black-throated Butcher-bird).—When I came here first, about 17 years ago, there were always a few pairs about the estate, and they used to breed in the white box trees near my house, but I have not seen or heard a single bird since 1907.



Nest and eggs of the Butcher Bird (*Cracticus destructor*) in a Bull Oak sapling.

Cracticus destructor (Butcher Bird).—There are always a few pairs to be met with scattered about the district, but mostly in the thicker forests, and once a pair take up their abode about any favoured clump of trees, if not disturbed they will breed there season after season, usually laying four eggs for a sitting. I have never found a larger clutch, but it is often only three, and all the nests I have examined containing eggs were found between September 12th and October 5th.

**Falcunculus frontatus* (Yellow-bellied Shrike Tit).—I have only seen one pair of these birds here, but a young friend found a pair building a nest this season, in which the birds eventually laid two eggs, and he sent me the nest.

Pachycephala rufiventris (Rufous-breasted Thickhead).—This species arrives during the early part of the spring, some years in great numbers, while in others scarcely a bird is to be found. They are mostly met with in the ironbark ranges, generally where there is plenty of undergrowth or saplings, and some years they breed here freely, usually laying three eggs for a sitting. I have never found a nest containing a larger clutch, and have only found eggs between October 9th and November 16th.

Eopsaltria australis (Yellow-breasted Shrike Robin).—A very common species on top of the rocky ironbark ranges, but I have never met with it in any other class of country in this district; it appears to avoid any country where there is water or even moisture. Their habits and notes are very different to the coastal form, and they have the power of ventriloquism. They breed here in great numbers, placing their nests at various heights from the ground. I have seen them from six to nearly sixty feet up, and they have a very long breeding season, probably rearing several broods in succession. They mostly lay two eggs for a sitting, but it is not uncommon to find clutches of three, and I have examined nests containing eggs from August 26th up till November 23rd. Even their eggs show a marked difference to those found near the coast; here they are mostly much brighter in colour.

Aphelocephala leucopsis (White-faced Titmouse).—Although seldom met with in scrubby country, it is undoubtedly the most common bird of the district. It is met with in very great numbers in all the open forests, mostly where the trees have been killed, and left standing; it also frequents gardens and orchards. Usually found in small communities feeding upon the ground, when disturbed they often only fly a short distance away and settle upon the ground again to continue their searching for food, and show very little fear of man. They breed here in great numbers, mostly placing their nests in hollow branches in dead trees, but often in hedges, and under the roofs of out-buildings. They are extremely close sitters; I have often chopped open their nesting hollows, and lifted a sitting bird from its eggs. They rear two or three broods during a season, usually laying three eggs for a sitting, but often four; I have never found a larger clutch. They have a long breeding season; I have taken fresh eggs from August 17th up till November 1st, and have noticed them building much later.

Climacteris picumna (Brown Tree-creeper).—Very seldom have I seen this species in the ironbark ranges, but in the more open forests and ring-barked country it is one of the most common birds of the district, breeding here in great numbers, mostly placing their nests in perpendicular hollow branches in dead trees, at various heights from the ground. I have several times found them in hollow posts in stockyards. They are rather early breeders, many of them laying during August, but I have never found a nest containing eggs later than October 3rd, and the clutch is nearly always three.

Climacteris scandens (White-throated Tree-creeper).—Plentiful in the thick ironbark forests on the ranges. It appears to prefer the class of country which the Brown Tree-creeper avoids. Their nests are placed at various heights from the ground; I have found them from eight to over fifty feet up, and have taken their eggs from August 31st up till October 17th, the clutch being either two or three eggs for a sitting.

Dicaeum hirundinaceum (Mistletoe Bird).—Although sparingly met with through all the forests of the district, it is very plentiful in the ironbark and sapling country, which appears to be its true home; when found in the open forests it is only on a visit. I have known them to come into my garden and feed upon the berries of the box-thorn hedges. They breed here freely, usually laying three eggs, and I have found their nests from four to thirty feet from the ground, and have examined them containing eggs from September 15th up till November 29th.

Pardalotus ornatus (Striated Pardalote).—A very common species, more especially where most of the timber has been killed. They are friendly little birds, showing little fear of man. Breeding here in great numbers, either placing their nests in hollows in trees or a hole drilled into a bank of a river or creek. They usually lay four eggs for a sitting during October.

Pardalotus punctatus (Spotted Pardalote).—It appears to be rather rare, but owing to its habits, it could easily escape notice, but I have only met with it in the ironbark ranges. When nesting, it drills a mouse-like hole into the flat ground almost anywhere amongst fallen eucalyptus leaves, and is only found by either flushing the bird or seeing it building.

Melithreptus brevirostris (Brown-headed Honey-eater).—Some years they arrive in rather large flocks early in the spring, and will be noticed travelling from tree to tree as if they were in a great hurry, but anything strange will at once attract their attention, and they come to very close quarters to make an inspection. When nest building they have a peculiar habit of plucking fur and hair from live animals; while sitting on horseback watching them, I have often had them come and perch upon the horse I was riding and try to pull hair out. Unless noticed in course of building their nests are very difficult to find, the birds being exceptionally close sitters. I have only found three of their nests, from two of which I took a Pallid Cuckoo's egg.

Plectorhamphus lanceolatus (Striped Honey-eater).—Rather a rare species in this district, only met with in scattered pairs, mostly in the more thickly-timbered country. They are exceptionally close sitters. I once found a nest with a bird sitting, over thirty feet from the ground, at the extreme end of a long thin branch, in a large ironbark tree. As I was many miles from home, and had nothing with me to enable me to get the eggs, excepting a tomahawk, I climbed the tree and cut the branch off, thinking I could hold it and allow it to swing down, but it proved to be too heavy, so I had to let it fall. While I was descending the tree, I noticed one of my spaniels go up to the nest, and, much to my surprise, she flushed the sitting bird. The nest contained four fresh eggs, only one of which was broken in the fall. When eggs are taken, the birds will often build another nest in the same tree, or a neighbouring one. The clutch is usually four.

Myzomela nigra (Black Honey-eater).—Until the present spring (1917) I had only seen about half-a-dozen of these birds here, and they put in an appearance during a very severe drought. This year they arrived in fair numbers during October, and started to breed almost immediately. Between October 26th and November 11th, I found twelve of their nests, each containing two eggs, and no doubt had I taken the trouble to look for them, could have found many more. No nest was more than two feet from the ground, and some of them only fifteen inches. I noticed that the female alone does all the nest building, and takes upon herself the entire task of incubation, and I found her to be a very close sitter; often she would allow me to approach within six feet before she would leave the nest. The male is rather shy, but never goes far away from the situation of the nest. Their call note is very similar to that of the Grass Bird, but is much more feeble.

Entomophila picta (Painted Honey-eater).—I had not seen this species in the district till the spring of 1914, when I found a pair building a nest in a pine tree, from which I took a pair of eggs on September 27th. I saw no more of these birds until the spring of the present year (1917), when about a dozen pairs put in an appearance in the ironbark ranges, and I found them to be amongst the most extraordinary little birds which have ever come under my notice. In some respects they somewhat resemble the Mistletoe Birds, otherwise they differ from any other species I know of. After spending all my spare time watching them for about six weeks, I had found eight of their nests, from three of which I took a pair of eggs, from one a clutch of three, another contained young when I found it, the other three were deserted, apparently before eggs were laid. The nests are about the most frail structures imaginable, often quite invisible from the ground. In some cases (when the birds are off the nest) the eggs only could be seen without field glasses. One of the strange things about them is, they take from three to four weeks to complete a nest. The lowest I found was placed exactly thirty feet from the ground, and the highest sixty-five feet. All the nests were built at the extreme end and in the leaves of a very long, thin horizontal branch

in an ironbark tree, in each case in flower. I know of no species building in a tree, the eggs of which are more difficult to secure. I have had to resort to means such as I have never used before. It is remarkable that the eggs or even the young birds remain in the nest during windy weather; it can only be by the birds sitting upon them.



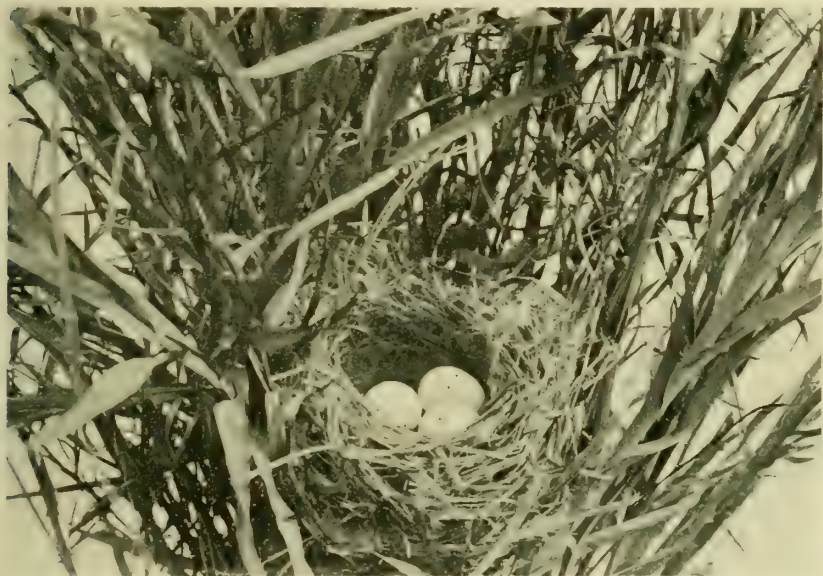
Nest and eggs of the Painted Honey-eater (*Entomophila picta*) in branch of an Ironbark Tree.

Meliphaga phrygia (Warty-faced Honey-eater).—Being a nomadic species, it arrives some years towards the end of the winter; as a rule most of them depart before the end of November. Some years, or even several years in succession, not a bird will be seen. Only once have I known them to remain here all through the winter. They breed here in great numbers, laying mostly two eggs for a sitting, but occasionally three, and they often become the foster parents of the Pallid Cuckoo. The nests are sometimes placed within a few feet of the ground, but it is no unusual thing to see them forty or fifty feet up. The earliest date on which I have taken their eggs is September 2nd, and the latest November 26th. The eggs vary considerably; I have them from a very pale salmon pink all over, with practically no markings, to a very rich reddish-buff, very darkly spotted on the apex, being darker in colour than any other Honey-eaters' eggs I have seen.

Ptilotis chrysops (Yellow-faced Honey-eater).—A very rare species in the whole district, and what few there are about are more often heard than seen. They live in the thick undergrowth on the ranges. I have only found two of their nests, one on November 16th, which contained an egg of the rightful owner, also an egg of the Pallid Cuckoo; the other, on September 17th, contained two heavily incubated eggs.

Ptilotis leucotis (White-eared Honey-eater).—Rather a common species on the ranges where there is thick undergrowth. Although a very shy bird, their curiosity often overcomes their fear. If an intruder keeps quite still they will gradually approach to within a few feet and peer at one in a most curious manner, but with the slightest movement they dart away into the scrub. Their

nests are very difficult to find, mostly being placed near the ground in a dense bush. They generally lay two eggs for a sitting, but occasionally three, and I have only taken them during the months of September and October.



Nest and eggs of the White-eared Honey-eater (*Ptilotis leucotis*) in a Blueberry Grass bush.

Ptilotis penicillata (White-plumed Honey-eater).—Wherever there are trees growing in the vicinity of water this species is sure to be found. In the redgums growing along the Talbragar River they are very numerous, nesting freely in their drooping branches, also in the river oaks, and several pairs breed in my garden every year. They nearly always lay three eggs for a sitting, and I have examined nests containing eggs from the first week in September till early in January.

Myzantha garrula (Noisy Miner).—A very common species in the open forests on the estate, but not found in the thick ironbark forests on the ranges. When the grapes are ripe they come into my garden to feast upon them, and become very tame, even coming into the house and hopping about without showing the least sign of fear. They breed here in fair numbers, usually placing their nests low down in a small tree or bush, but occasionally they will be seen high up in a very large tree. Generally they lay three eggs for a sitting, but sometimes four. I have never taken a larger clutch, and I have examined nests containing eggs from August 25th till as late as October 31st.

Anthochaera carunculata (Red Wattle Bird).—Some years, towards the end of the winter, more especially if the native apple trees are in bloom, this species arrives in thousands, and the effect of their curious notes uttered by so many birds is most extraordinary. Not many of them remain here to breed, but those that do so mostly commence very early. I have seen young birds out of the nest early in September, and have taken their eggs from August 22nd up till October 19th. The clutch is usually two, only twice have I found three.

Entomyza cyanotis (Blue-faced Honey-eater).—A common species on the estate at all times, usually met with in pairs or small flocks of about half a dozen or more, but I have never seen them

in the thick ironbark forests. They breed here, but I have never known them to entirely build a nest for themselves. Of about twenty I have examined, all have been inside old Babbler's nests. Enlarging the entrance they roughly reline it with bits of bark and dry grass. I have never found a clutch of more than two eggs, and I have taken them from August 22nd till as late as October 25th.

Tropidorhynchus corniculatus (Friar Bird).—A common species everywhere, more especially in the spring, sometimes arriving in great numbers, but they do not all remain here to breed. In certain localities on some of the sandy flats between the ranges, a fair number of them breed every year, placing their nests near the end of a long thin horizontal branch, mostly in ironbark and stringybark trees. Very few of them can be climbed out to; to secure their eggs it is usually necessary to scoop them. I have examined about thirty-five of their nests, but have only been able to put my hand in two of them in its natural position. Three eggs is generally the full clutch, but I once took a set of four. They are rather late breeders, the earliest record I have of taking eggs being September 28th, and the latest December 16th.

Philemon citreigularis (Yellow-throated Friar-bird).—A very common species here during the spring and summer months, but they are seldom found far away from water. They breed here freely, mostly building their nests in the redgums, river oaks and native apple trees growing on the banks of the river. I know of no bird the nests of which differ so greatly; some are rather frail structures, loosely constructed, composed of dry grasses, while others are great bulky structures, neatly made within, but almost entirely composed of wool from sheep. Three eggs is the usual clutch for a sitting; I have only once found a set of four. They are late breeders, mostly laying during November, but I have taken eggs as early as September 30th and as late as January 12th.

Anthus australis (Ground Lark).—A very common species on all the open country on the estate. They breed here in great numbers, sometimes placing their nests in an old rusty jam tin. They evidently rear several broods during a season, because I have seen nests containing eggs from August 25th till as late as November 12th. The usual clutch is three, but often four.

Mirafra horsfieldi (Bush Lark).—A rather rare species here, only odd pairs and single birds turning up in good springs. I once caught a young bird which had only just left the nest.

Steganopleura guttata (Spotted-sided Finch).—A common species throughout the district, in all classes of country, often seen in gardens, and frequently found building their bulky nests in creepers growing on the sides of verandahs. Wherever a Brown Hawk's nest is found there are sure to be several nests of this Finch in close proximity, mostly in the same tree, and usually two or three attached to the underneath part of the larger nest. I once counted twenty-two nests in a single tree. They lay from three to six eggs for a sitting, and are not very particular at what time of the year they breed. I have examined nests containing eggs from June 23rd up till January 15th. They use the old nest for roosting purposes long after the young birds can fly.

Taeniopygia castanotis (Chestnut-eared Finch).—Some years enormous flocks of this species put in an appearance, but most of them disappear before they breed—in fact, very few of them breed here at all; those that do, build a nest within a hollow branch of a dead tree. One evening I saw a bird enter a hole in a dead tree, about six feet from the ground; upon giving it a knock with a tomahawk out flew about a dozen of these birds.

Aidemosyne modesta (Plum-headed Finch).—A very rare species in this district. I have not seen more than a dozen birds, just an odd pair turning up any year in the spring. At present a pair have taken up their abode about my house. I often see them in my garden; they come on to a lawn only a few steps off my verandah, and pick up feathers blown there from a white cockatoo which is kept in a cage on the verandah, so they are evidently building somewhere close about. I have only found three of their nests containing eggs, and the clutches were four, five and six, all found during the month of November. Two of the nests were placed in black thistles, the other in a tussock on the bank of the river.

Oriolus sagittarius (Oriole).—Not by any means a common species, but there are usually a few of them scattered about the district during the spring, often coming into my garden when the grapes are ripe. Excepting when breeding, they go about singly. I have only found three of their nests, each of which contained three eggs.

Corone australis (Raven).—This well-known species is numerous at all times throughout the district, but is more frequently met with in the open country, although they often resort to the iron-bark ranges to breed, usually choosing a very large tree in which to place their nest, and, if their eggs are destroyed, they will often lay another clutch in the same nest within a few days. The earliest date I have taken their eggs is July 7th, and the latest October 14th—the latter probably being a second laying. Most of them lay during July and August, and the clutch is generally four or five, but it is no unusual thing to find six. During droughts, when sheep are in very low condition, also in the lambing season, these birds do a great amount of damage; stockowners, as a rule, do all they can to destroy them, which is no easy matter. When poor sheep get down, they are almost immediately attacked by these birds, firstly pecking out an eye, or both, from which treatment I have never known a sheep to recover; whether this is owing to the fact that the raven, being a carrion feeder, causes blood poisoning, remains to be proved. Few people have a good word to say for them, and nobody ever fails to try and shoot a raven if the opportunity arises. But, excepting during droughts and the lambing season, they do little damage, the worst probably being the taking of chickens, young turkeys, and eggs, at which they are experts, and their depredations in the fowl-yard are only too well known to most people living in the country districts where ravens abound. The bird is therefore condemned by most people as a curse to the country, and probably not without reason; but, on the other hand, it has much in its favour, so I will now mention some of its good traits. The bird being a scavenger cleans up a vast amount of offal and carcasses of dead animals, destroying thousands of noxious insects, maggots, and even blow-flies themselves. Dead stock and rabbits, etc., are so destroyed that nothing but skin and bone remains, and the maggots are destroyed that would otherwise have entered the ground and escaped to eventually do their damage in turn later on. I consider that the raven is our best natural enemy of the blow-fly, and is also a most effective enemy of grasshoppers in certain stages. While there is no question as to the damage done in some districts to ewes and lambs in bad seasons, at other times of the year it is a friend in disguise; so, if it would only leave the sheep alone, it would be one of our most useful birds.

Strepera graculina (Pied Crow Shrike).—Some years during the winter small flocks of this species will arrive, though most of them never stay long, but there are always a few pairs of birds in the district. They breed here, but very sparingly; I have only found four nests containing eggs, and six with young birds. They usually place their nest near the extreme end of a long, thin horizontal branch, high up in a large tree. The eggs I have taken here show very little variation.

Struthidea cinerea (Apostle Bird).—A very common bird on the estate, but I have never found them entering far into the ranges. They prefer the more open forests where there are clumps of pine trees, in which many of them construct their nests, usually laying four eggs for a sitting, but I have found as many as seven. I have taken their eggs from September 5th up till November 5th. I have never yet seen a single bird with white eyes, and I have searched flock after flock with field glasses.

Corcorax melanorhamphus (Chough).—A very common species throughout the district, but more especially in the more open forests. They breed here in great numbers. During 1908 I made a special study of their eggs. I examined no less than twenty-seven clutches, and they ranged from three to eight, but I found in every case where there were more than five eggs in a nest they were of two distinct types, but where there were five or less I am quite satisfied they were laid by the same female. They start breeding early, most of them laying during August, but I have taken eggs as late as December 5th.



Nest and eggs of the White-winged Chough (*Corcorax melanorhamphus*)
on branch of a dead Yellow Box Tree.

SPECIES IDENTIFIED, BUT NOT KNOWN TO BREED IN THIS DISTRICT, MOST OF
THEM BEING VISITORS.

- Ocyphaps lophotes* (Crested Pigeon).
Gallinula tenebrosa (Black Moor Hen).
Porphyrio melanotus (Bald Coot).
Fulica australis (Coot).
Hydrochelidon hybrida (Marsh Tern).
Larus novae-hollandiae (Silver Gull).
Erythrogonyx cinctus (Red-kneed Dotterel).
Himantopus leucocephalus (White-headed Stilt).
Pisobia ruficollis (Little Stint).
Gallinago australis (Snipe).
Rostratula australis (Painted Snipe).
Eupodotis australis (Bustard).
Antigone australasiana (Native Companion).
Ibis molucca (White Ibis).
Carpibis spinicollis (Straw-necked Ibis).
Plegadis falcinellus (Glossy Ibis).
Platibis flavipes (Yellow-billed Spoonbill).
Herodias timoriensis (White Egret).
Chenopsis atrata (Black Swan).
Dendrocygna exoni (Plumed Whistling Duck).

Spatula rhynchotis (Blue-winged Duck).
Malacorhynchus membranaceus (Pink-eared Duck).
Stictonetta naevosa (Freckled Duck).
Aythia australis (Hard-head Duck).
Biziura lobata (Musk Duck).
Phalacrocorax carbo (Black Cormorant).
Phalacrocorax sulcirostris (Little Black Cormorant).
Phalacrocorax melanoleucus (Little Cormorant).
Plotus novae-hollandiae (Darter).
Pelecanus conspicillatus (Pelican).
Circus assimilis (Spotted Harrier).
Circus gouldi (Swamp Hawk).
Milvus affinis (Kite).
Elanus axillaris (Black-shouldered Kite).
Falco melanogenys (Black-cheeked Falcon).
Falco subniger (Black Falcon).
Falco hypoleucus (Grey Falcon).
Cacatua roseicapilla (Rose-breasted Cockatoo).
Platycercus elegans (Pennant Parrakeet).
Platycercus splendidus (Yellow-mantled Parrakeet).
Alcyon azurea (Azure Kingfisher).
Chaetura caudacuta (Spine-tailed Swift).
Cypselus pacificus (White-rumped Swift).
Scythrops novae-hollandiae (Channel-bill).
Petroeca leggei (Scarlet-breasted Robin).
Coracina mentalis (Little Cuckoo Shrike).
Acanthiza lineata (Striated Tit).
Pachycephala pectoralis (White throated Thickhead).
Zosterops caeruleascens (Silver-eye).
Melithreptus atricapillus (Lunulated Honey-eater).
Melithreptus affinis (Black-headed Honey-eater).
Acanthorhynchus tenuirostris (Spine-billed Honey-eater).
Ptilotis melanops (Yellow-tufted Honey-eater).
Ptilotis ornata (Yellow-plumed Honey-eater).
Myzantha flavigula (Yellow-throated Miner).
Anellobia chrysoptera (Brush Wattle-bird).
Acanthogenys ruficularis (Spiny-cheeked Honey-eater).
Corvus bennetti (Bennett's Crow).

CONTENTS OF PART 1.

	Page
Report of the Council for 1913.....	1
The Mallophaga as a possible clue to Bird Phylogeny, by Launcelet Harrison, B.Sc.....	7
Bird Sanctuaries, by A. F. Basset Hull.....	13
A Monograph of the genus <i>Tisiphona</i> , Hübner, by G. A. Waterhouse, B.Sc., B.E., F.E.S.....	15
A new Victorian Araneiad, by W. J. Rainbow, F.E.S.....	21
Notes on the Breeding-habits of the Purple-striped Gudgeon, <i>Krefflius adspersus</i> , Castelnau, by Albert Gale.....	25
A new Australian Caprellid, by the Rev. Thomas R. R. Stebbing, M.A., F.R.S., F.L.S., F.Z.S..	27
Notes on some Australian Syngnathidae, by A. R. McCulloch.....	29
Bird Notes from the North-west of New South Wales, by Walter W. Froggatt, F.L.S.....	33
An Interesting Exhibit, by A. S. Le Souef, Director, Zoological Gardens.....	35

CONTENTS OF PART 2.

Report of the Council for 1914.....	37
List of Members, 1914.....	41
Bird Notes, by Walter W. Froggatt, F.L.S.....	44
Two Beetles apparently new to Australia, by W. J. Rainbow, F.E.S.....	46
The Migration of the Jolly-tail or Eel Gudgeon, <i>Galaxias attenuatus</i> , from the sea to fresh-water, by A. R. McCulloch.....	47
Further notes on the genus <i>Tisiphona</i> , Hübner, by G. A. Waterhouse, B.Sc., B.E., F.E.S.....	50

CONTENTS OF PART 3.

Report of the Council for 1915.....	53
Some new Araneidae from the County of Cumberland, by W. J. Rainbow, F.E.S.....	58
Notes on Colour-variation of Opossums of the genus <i>Trichosurus</i> , by A. S. Le Souef, Director Zoological Gardens.....	62

CONTENTS OF PART 4.

	Front Pages
Report of the Council for 1916.....	Front Pages
The Royal Zoological Society of New South Wales. Its present position and future aims, by A. F. Basset Hull, President.....	65
The Economics of <i>Trochus niloticus</i> , by Charles Hedley.....	69
The Destruction of Bird Life in Australia, by Walter W. Froggatt, F.L.S.....	75
The Lyre Bird: Some Nesting Notes, by John Ramsay and Albert E. Keene.....	81
Kangaroos in Captivity, by H. L. White.....	83
Illustrations of Australian Coleoptera, by A. Musgrave and E. H. Zeck.....	85
The deposition of the eggs of Monotremes, by Harry Burrell.....	87
Ichthyological notes, by Allan R. McCulloch.....	89
The Great Black Palm Cockatoo, <i>Microglossus aterrimus</i> , in captivity, by Dr. E. A. D'Ombrian, M.R.A.O.U.....	95

CONTENTS OF PART 5.

Taronga Zoological Park.....	99
Royal Zoological Society of New South Wales.....	100
The Distribution of <i>Anaspides</i> and <i>Ooperipatus</i> in Tasmania, by Professor T. Thomson Flynn..	102
Birds in my Garden, by Henry L. White.....	103
The Birds of the Cobbora District, by Thomas P. Austin.....	109

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ALLAN R. McCULLOCH,
Zoologist, Australian Museum

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Royal Zoological Society of New South Wales

ESTABLISHED 1879

REGISTERED UNDER THE COMPANIES ACT, 1899 (1917)

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Associate Member, 7s. 6d. „ „

PRIVILEGES :

Ordinary Members—Free admission to Taronga Zoological Park ; Additional Tickets admitting 20 Adults or 40 Children ; Free Copy of " Australian Zoologist."

Associate Members—Free Copy of " Australian Zoologist."



Royal Zoological Society of New South Wales.

IN accordance with Article 41 of the Articles of Association, the first annual general meeting of the Society was held at Taronga Zoological Park on Saturday, 27th July, 1918, at 3 p.m.

Twenty-one members were present.

PRESIDENTIAL ADDRESS.

The President (Mr. A. F. Basset Hull) read the following report :—

Ladies and Gentlemen,—The last annual meeting of what is now known as the "old Society" was held at the Royal Society's House, Sydney, on 27th February, 1917, on which occasion Mr. J. H. Campbell, Dr. H. G. (now Professor) Chapman, Dr. E. A. D'Ombrian, Mr. W. W. Froggatt, F.L.S., Colonel Alfred Spain, V.D., and Mr. S. T. D. Symons, M.R.C.V.S., were elected to fill the vacancies in the Council occurring under the Constitution; and at a meeting of the Council held on 5th March, 1917, the following members were elected officers :—President, Mr. A. F. Basset Hull, R.A.O.U.; Vice-Presidents, Messrs. H. E. Finckh, W. W. Froggatt, F.L.S., A. E. Jaques, and S. T. D. Symons, M.R.C.V.S.; Honorary Secretary and Treasurer, Mr. G. A. Waterhouse, B.Sc., B.E., F.E.S.; Honorary Librarian, Mr. H. E. Finckh; Publication Committee, the President and Honorary Secretary, Messrs. C. Hedley, F.L.S., and A. R. McCulloch (Honorary Editor).

On 30th June, 1917, a general meeting was held at Taronga Park to formally adopt a draft Memorandum and Articles of Association for the purpose of securing the registration of the Society under the provisions of the Companies Act, 1899, as a limited liability Company not carrying on business for profit. The draft was duly adopted, a confirmatory meeting was held on 19th July, and the registration of the Society under a new and wider constitution was effected on 17th August, 1917. By virtue of Article 17 of the Articles of Association the officers of the "old Society" remained in office until the end of the new financial year, which terminates on 30th June, instead of 31st December as under the old constitution.

Having now completed the first year of our existence as an incorporated body, it is necessary for the purpose of continuity of record to review the whole period since the last annual meeting of the old Society.

During this period Messrs. T. W. Keele, A. E. Nash and J. M. Smail resigned from the Council, and the vacancies thus created were filled by the election of Professor S. J. Johnston, Messrs. W. C. Shipway and D. W. C. Shiress, who, under the provisions of Article 23, come before you to-day for re-election.

Members of Council attended meetings as follows :—Messrs. Hull and Waterhouse, 12; Mr. Finckh, 11; Mr. Campbell and Dr. D'Ombrian, 9; Mr. McCulloch, 8; Mr. Hedley and Dr. Dodd, 7; Mr. Symons, 6; Messrs. Froggatt and Shipway, 5; Mr. Rainbow, 4; Dr. Johnston, Colonel Spain and Mr. Shiress, 3; Dr. Chapman and Mr. Jaques, 2; Dr. Todd was granted leave of absence.

The overshadowing influence of the war has necessarily limited the Society's operations, and your Council has felt that the time is not yet opportune to make any appeal for the funds which would be required to carry out the wider aims of the Society as set out in the Memorandum of Association. It was content to consolidate its position and await that lifting of the war cloud, towards which we direct our hopes and prayers.

The Balance Sheet which is placed before you to-day reveals a position which may be regarded as satisfactory, inasmuch as our expenditure has been kept well within our income, and a modest beginning has been made in the establishment of a Capital Fund.

The membership at the time of registration was fixed, for the formal purposes of the Act, at twenty, but an increase of 250 was subsequently sanctioned and registered, making a total of 270 as the maximum number that may be admitted as members without further registration. The number of actual members, however, is yet far short of the authorised quota, the roll on the 30th June, 1918, containing 7 Honorary, 140 Ordinary, and 7 Associate Members. Your Council invites your co-operation in an endeavour to increase the number on the roll to such an extent that additional registration will be necessary. In this connection, you may remember that the privileges of free admission to Taronga Park are accorded to a maximum of 300 members and that every member above that number means an addition of £1 *rs.* per annum to the income of the Park Trust.

During the period under review, two parts (Nos. 4 and 5) of the "Australian Zoologist" have been issued. Your Council feels that the existing war conditions, and the consequent heavy cost of paper and printing, preclude any great increase in the output of publications, but it will endeavour to issue sufficient to provide a means of communication between Council and members, and of recording the results of individual observation and research in zoology. That the Commonwealth Bureau of Science and Industry has re-issued Mr. Hedley's article on the Economics of *Trochus niloticus* as one of its Bulletins is a subject of gratification to your Council.

The Trustees of Taronga Park have been good enough to afford special facilities to members of this Society resident at Mosman, by opening the gates of the Park to them in the morning before the usual hour.

Reference has already been made to the establishment of a Capital Fund, into which it is proposed to pay all unconditional cash donations, subscriptions of life members, fines under the Birds and Animals Protection Acts, and such other funds as the Council may determine. ("Australian Zoologist," vol. 1, p. 100.) As a beginning, application has been made for £100 Funded Stock in the Sixth War Loan.

A Bill for the Protection of Native Birds and Animals is now before Parliament, and in view of the fact that it is proposed to repeal the existing provisions contained in the Birds Protection Act, 1901, and the Native Animals Protection Act, 1903, under which this Society receives one half of the fines imposed on offenders against those Acts, your Council has made application to the State Government for a subsidy, and the matter is receiving consideration.

THE WANT OF AUSTRALIAN NATURAL HISTORY HAND-BOOKS.

During his term of office as Governor of this State, Lord Chelmsford, in opening a new wing of the Australian Museum, referred to the want of cheap hand-books to the butterflies, birds, etc., of Australia, and attributed the dearth of Australian boy-collectors to this want. He instanced the numerous and inexpensive hand-books available for the use of the British boy-collector.

The absence of such hand-books is not due to the lack of men capable of writing them, but to three reasons, none of which is applicable to Great Britain. In the first place, the market is limited. For one young collector (actual or potential) in Australia there are ten in Great Britain. In the second place, the cost of locally printing and publishing properly illustrated works is very much greater than in England, and even if the manuscript were sent to England for printing, the cost of supervision, freight, and other charges would add considerably to the price at which the books could be sold in Australia. In the third place, the number of species in each branch of natural history is very much larger in Australia than in Great Britain. In the case of the butterflies, there are about 86 species recorded

as visiting the British Isles: many of these are occasional visitors only, and consequently very rare, and owing to the greater proportion of recording collectors and the limited area of the region, it may be regarded as improbable that many additional species will ever be recorded. In Australia we have 332 species recorded, and every year brings us records of new species discovered, not only in the less explored districts, but even in the long settled country. The list of British birds—resident, migratory, and occasional visitors—totals 370 species, and these were dealt with by Dr. Bowdler-Sharpe in four handy octavo volumes, costing 2s. 6d. each. There are 700 distinct species of Australian birds, and the latest list compiled by Gregory M. Mathews, adds nearly 1,000 sub-species or varieties. To deal with the distinct species only would require eight volumes of a size equal to Bowdler-Sharpe's, and, locally produced, the cost would certainly exceed 5s. per volume.

As regards moths, beetles, marine and terrestrial shells, and, in fact, every branch of natural history, the preponderance of species to be described, and the relatively higher cost of production, would make Australian hand-books so much more expensive than those produced in Great Britain for British collectors that the price would, in every instance, be beyond the reach of the average boy.

There are a few books, such as Dr. Leach's "Australian Birds," and Rainbow's "Butterflies," published at a low price, but there are practically none on any other branch of natural history. Lucas and Le Souef's "Birds and Animals of Australia" are praiseworthy efforts to fill the want, but the price is virtually prohibitive. Waterhouse and Lyell's "Butterflies of Australia," North's "Nests and Eggs," Cox's "Land Shells," and many other works might be cited—all very fine publications, indeed, but neither hand-books nor cheap, within the meaning of Lord Chelmsford's plaint.

Here, then, is a solution. This Society numbers amongst its members men capable of writing the required hand-books. It only requires the funds to print and illustrate them, and having no rent and no salaried managers or salesmen to pay, it could afford to place them on the market at or below cost price for the instruction and entertainment of those desiring to learn about the many rare, beautiful or interesting forms comprised in the fauna of Australia. Some day another Sir William Macleay will enter this Society, or a few men as public-spirited as he was will combine to provide funds which, properly invested, will yield an income sufficient to secure the issue, at stated periods, of the wanted "cheap" hand-books.

The following members were elected to fill vacancies in the Council, in accordance with the provisions of Article 23:—Professor Stephen J. Johnston, Dr. R. H. Todd, Messrs. A. R. McCulloch, W. C. Shipway, D. W. C. Shiress, and G. A. Waterhouse.

At a meeting of the Council held at the conclusion of the Annual General Meeting, the following officers were elected:—President, A. F. Basset Hull, R.A.O.U.; Vice-Presidents, H. E. Finckh, W. W. Froggatt, F.L.S., F.E.S., C. Hedley, F.L.S., S. T. D. Symons, M.R.C.V.S.; Honorary Secretary and Honorary Treasurer, G. A. Waterhouse, B.Sc., B.E., F.E.S.; Honorary Librarian, H. E. Finckh.

List of Members

OF THE

Royal Zoological Society of New South Wales

ON 30th SEPTEMBER, 1918

ORDINARY MEMBERS.

- ANDREWS, ERNEST CLAYTON, B.A., Geological Surveyor, Dept. of Mines, Sydney.
- ARCHER, J. M., Club House, Kirribilli Point, Milson's Point.
- *AUSTIN, THOMAS PHILLIPS, Cebborah Estate, Cobbora.
- BARLING, Miss S. M., St. Adrians, Raglan St., Mosman.
- *EENNETT, FREDERICK OWEN, Kurkulla, Wilga Street, Bondi.
- BENSON, NORMAN N., St. George, Ruby Street, Mosman.
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- BURNSIDE, JAMES H., 90 Beach Road, Darling Point.
- BURRELL, HARRY, La Mascotte, Doncaster Avenue, Kensington.
- BURRELL, Mrs. HARRY, La Mascotte, Doncaster Avenue, Kensington.
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- CAYLEY, NEVILLE W., 183 Pitt Street, Sydney.
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- CHAPMAN, HENRY GEORGE, M.D., B.S., Professor of Pharmacology, Royal Society, Elizabeth Street, Sydney.
- CHEESEMAN, EDWARD THOMAS, Hotel Sydney.
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- COX, Sir OWEN, K.B.E., 4 Bridge Street, Sydney.
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- DUN, WILLIAM SUTHERLAND, Palaeontologist, Department of Mines, Sydney.

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NOTES ON SOME OF THE SMALLER MARSUPIALS OF THE GENERA *PHASCOGALE*,
SMINTHOPSIS, *ACROBATES* AND *DRONICIA*.

By A. S. LE SOUEF, Secretary Taronga Zoological Park, and HARRY BURRELL.

FOR some years past we have been endeavouring to procure and photograph living specimens of the smaller marsupials, and to learn something of their life history, as comparatively few have been studied in the live state. It has proved rather hard to procure the animals, since they are not recognised as being of any special interest by those who chance upon them, they being generally classed as rats or mice, and killed as vermin. Moreover the clearing and occupation of the country, and the introduced cat and the fox are threatening the extermination of some species. It would further appear that disease also has affected them, since the Native Cats, *Dasyurus*, and the Marsupial Rats, *Phascogale*, seem to have practically disappeared over large areas of Eastern Australia about the same time as the Native Bears, *Phascolarctus*, were almost exterminated by what appeared to be an eye affection, after the drought of 1903. All these animals were extremely numerous twenty years ago, but diligent search now only proves their scarcity—at any rate in most parts of New South Wales. The Native Cat seems to be numerous only in the vicinity of Sydney, while the Native Bears, while still having stronghold in the Victorian National Park at Wilson Promontory, are elsewhere far from common.

As different animals may have a predilection for particular trees, we suggest that the species of tree on which an arboreal animal occurs might be noted with advantage.

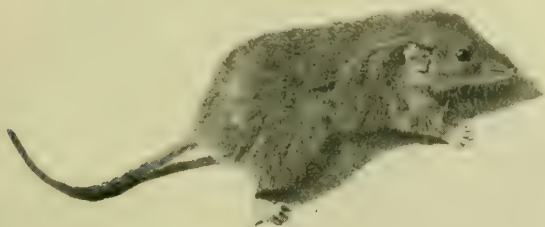


Fig. 1a.

THE YELLOW-FOOTED POUCHEE MOUSE, *Phascogale flavipes*. (Figs. 1a. 1b. and 1c.)

This species is fairly common in the County of Cumberland, around Sydney, and we have also received specimens from Robertson, Marsden, Widgiewa, and Koorawatha, in the south-west of the State. During the breeding season, we have found specimens living in sandstone caves, where they make compact nests of eucalyptus leaves in the weather-worn holes common in these shelters. An

interesting account of this species, its nest and breeding, has been contributed by Mr. E. R. Waite.¹ The animals are easy to trap, the white larva of a beetle forming an irresistible bait, and they live well in captivity, feeding on meat, insects and sugar; and they are especially fond of spongecake.

Specimens examined by us exhibit considerable variation in both size and colour, though all are apparently referable to the one species. Two females from Robertson, New South Wales, measure 100 mm. without the tail, which is 85 mm. long; the fur is soft and fine, and the tail is thinly haired



Fig. 1b.



Fig. 1c.—Sandstone cave in which *Phasogale flavipe* makes its nest.

1. Waite, P.L.S., N.S.W., xxi., 1896, pp. 349-350.

throughout; they are dark mouse-grey above and greyish white below, with feet of the same colour as the back. Two large males, from the National Park, near Sydney, have longer hair, and are darker in colour; the head and body measure 120 mm. and the tail 93 mm. Specimens from west of the Blue Mountains are much lighter in colour, being fawn-grey on the upper parts and yellowish-white on the under parts and feet; the line between the back and the belly is fulvous; the proximal half of the tail is the same colour as the back, but the distal half is black, with the hair increasing in length towards the tip, where it forms a slight crest. A male measures, head and body, 110 mm., tail 88 mm.

THE FAT-TAILED POUCHED MOUSE, *Sminthopsis crassicaudata*.

This pretty little animal is about the size of an ordinary house-mouse, but in appearance and movements has characteristics of its own. It frequently sits up on its hind legs, like a kangaroo, and, when running, progresses with a jumpy movement somewhat between a run and a hop. Specimens are found living on the ground, sheltering under logs, posts, heaps of grass, etc., where they make neat little circular nests, open on top, and about three inches in diameter. They seem to be only in evidence on the surface of the ground in winter, or more probably in the wet season, as a careful



Fig. 2a.

search in their haunts in dry weather, failed to locate any trace of them, other than their abandoned nests. We surmise that they go into deep cracks which open up in these western plains in the summer. In captivity, they are both insectivorous and carnivorous, and in summer the tail becomes thickened with accumulated fat. The general colour of the upper parts is fawn, while the under parts are white; there is a rather indistinct dark mark round the eye, and a brown band on the outer side of the ear. A male specimen in Taronga Park measures 88 mm. without the tail, which is 51 mm. long.

We have had this species from Widgiewa, Western New South Wales, and Mr. A. C. Bligh has reported it from Condamine Plains, Brookstead, Queensland.



Fig. 2b.—Stump showing location of nest of Pygmy Flying Opossum.



Fig. 2c.—Nest of Pygmy Flying Opossum.

THE PYGMY FLYING OPOSSUM, *Acrobates pygmaeus*. (Figs. 2a. 2b. and 2c.)

This well-known little animal, the smallest and most delicate of our marsupials, is found in Eastern Australia. It seems to be fairly plentiful in timbered country, and we have located it in the heavy forests west of the Dorrigo. There we found its very compact nests formed of eucalyptus leaves, and placed in small holes in the trunks of the Giant White Gums, *Eucalyptus regnans*. They were rounded in shape and open at the top, and several were located in excrescences of these trees which are known as niggerheads. The first nest found was situated perhaps one hundred feet from the ground, and contained an adult pair, the female with young in the pouch, and two smaller specimens. Mr. S. A. Hanscome found a nest of *Acrobates* at Seaham in a small stump about a foot from the ground, and constructed of grass and leaves; and the photo which he kindly supplied, well

illustrates the locality and the nest itself. In captivity the Pygmy Flying Opossum will feed on sugar, but it very much prefers white ants, which together with the white exudate of certain insects, called manna, probably forms its food in the native state.

The general colour of the upper parts is soft grey, and the under parts white; but skins from Queensland have a brownish or coppery wash over the grey. Although the tail is not prehensile, it is able to grip on a smooth surface by the transverse ridges on the under side, which faculty is probably more useful than prehensility would be on the smooth surface of the Eucalypts.



Fig. 3.

THE PYGMY OPOSSUM, *Dromicia nana*. (Figs. 3 and 4.)

This little animal though common in Tasmania, has been rarely recognised in south-eastern Australia. Krefft recorded two specimens from the vicinity of Sydney in 1863, but Thomas² states of these: "I have no doubt that both escaped from captivity, as the species has never otherwise been recorded from the mainland."

We now find them to be numerous in some parts over a wide range. Our first specimen was found by Mrs. E. H. Kater at the Fitzroy Falls, near Moss Vale, in 1914, and many have since been secured for us by Mr. Brand and Mr. Lloyd Cooper from the vicinity of National Park, about 20 miles from Sydney, where the species is quite plentiful. It has also been noticed by the ranger at Kurnell Park, near La Perouse. Mr. Kershaw, Curator of the National Museum, Melbourne, states that specimens are in the collection under his charge from Mordialloc, near Melbourne, Muckleford, near Castlemaine, and from Western Port. Mr. E. R. Waite records it from Jindabine, N.S.W.

We have found the nests of this species in hollow limbs in three species of Eucalyptus trees, *E. squamosa*, *E. piperita*, and *E. haemastoma*. They were made principally of Eucalyptus leaves, but were always lined with the leaves of the Christmas Bush, *Ceratopetalum*, which in some cases had evidently been brought from a considerable distance.

All the *Dromicia* from South-eastern Australia we have handled have been small delicate animals when captured, but in captivity they have sometimes become very fat and altered in shape; the slender animal shown in Fig. 3 became in three months the stout individual on the left of Fig. 4. The specimens we have had from National Park show marked variation in colour and

2. Thomas, British Museum Cat. Marsupialia, 1888, p. 146.



Fig. 4.

form, and they vary a little in size, but they are consistently smaller than the Tasmanian specimens, from which they also differ in having less fawn in their colouration, and in having the under parts more distinctly white. We think that a more detailed comparison of series of specimens from both South-eastern Australia and Tasmania will prove the mainland form as distinct, as was considered by Krefft³, who named it *D. unicolor*. Pigmy Opossums are most defenceless little creatures, since they are not active; when handled, they seldom attempt to bite, and only make a slight hiss to indicate their objection. In captivity they feed on fruit, nuts, and sugar, and in cold weather go into complete hibernation. Male specimens now alive in Taronga Park have the fur soft and somewhat woolly; the upper parts are dull grey, with a slight fawn wash, and the under parts are dull white, the division of the two being indistinct. The form is stout, and the tail is thickened at the base. Another male from the same locality has the fur short and fine, not woolly; the upper parts are dark-brownish-grey, and the under parts are white, with the division between them distinct; the form is slender and light, and the tail is not thickened.

The following are rough measurements of eight living specimens:—

MALES.

Head and body,	92 mm.;	tail,	93 mm.
" " "	90 mm.;	" "	90 mm.
" " "	85 mm.;	" "	85 mm.
" " "	74 mm.;	" "	84 mm.
" " "	70 mm.;	" "	80 mm.

FEMALES.

Head and body,	88 mm.;	tail,	90 mm.
" " "	85 mm.;	" "	90 mm.
" " "	80 mm.;	" "	80 mm.

3. Krefft, Proc. Zool. Soc. Lond., 1863, p. 49.

NOTES ON RECORDS OF TREE KANGAROOS IN QUEENSLAND.

By T. HARVEY JOHNSTON, M.A., D.Sc., and C. D. GILLIES, M.Sc., University of Queensland, Brisbane.

THROUGH the long isolation of the Australian or Notogacic zoo-geographical region, its marsupial fauna has undergone great specialisation, resulting in some strange adaptations. Prominent among these are the Tree-kangaroos of the genus *Dendrolagus*, which includes five species. Of these three are confined to New Guinea and two, *D. lumholtzi*, Collett, and *D. bennettianus*, De Vis, occur in Queensland.

The first Queensland species to be actually described was *D. lumholtzi*, an account of which was given by Collett in 1884, based on material collected near Herbert Vale, North Queensland, by Dr. Lumholtz. The latter gave an account of the habits of this interesting animal in a paper published soon after that by Collett. These have generally been regarded as being the first notices of the presence of Tree-kangaroos in Australia. Quite recently, however, Mr. F. W. S. Cumbræ-Stewart, the Registrar of the University of Queensland and President of the Queensland Historical Society, brought under our notice a much earlier reference to the animal in a report of the Hann Expedition to the York Peninsula in 1872. He has also been kind enough to collect further information from Dr. Thomas Tate, a surviving member of the party, and has placed at our disposal extracts which that gentleman made from his original diary. We take this opportunity of expressing our appreciation of the kindness of Mr. Cumbræ-Stewart.

EXTRACT FROM QUEENSLAND VOTES AND PROCEEDINGS FOR 1873, RELATING TO MR. HANN'S REPORT OF HIS EXPEDITION IN 1872.

"Saturday, 12th October, (1872).— And here I may as well mention what Jerry told me about an animal found in these scrubs, as related to him by the Cardwell blacks. He says that it is a kangaroo or something like it, and climbs trees, and he was fortunate enough to see one on a day when we were camped among scrubs, in which he was hunting for the eggs of the scrub turkey. According to his statement, he at first took it for a 'miall' blackfellow, but found it to be an animal; it ran up a tree and disappeared. He has not seen monkeys, but says that it is not a monkey, neither is it a bear; yet, like the first, it chatters, and, unlike the latter, it is very agile in its movements, as it climbs or swings itself among the branches when disappearing. I went the next day to the scrub with Dr. Tate and Jerry, thinking to see one, but was not fortunate enough in doing so; then Jerry took us to the very tree where he had seen the animal, on the bark of which were two deep scratches, but no other marks by which an animal could assist itself to climb; the marks were totally different from those of an opossum, which leaves marks as if made with a pin's point, being very fine, and I question whether a bear leaves any marks; those in question appeared to have been made with toes on the hind feet, but no animal could run up a smooth, straight surface with only its hind feet, without receiving assistance from the forearm, which in this case had left no marks; we saw similar marks on numerous trees, so I imagine the animal to be plentiful. To entertain the idea that any kangaroo known to us, or approaching its formation, could climb a tree, would be ridiculous; the animal was not formed for such work, but that there is an animal in these scrubs not known to us, I believe, because I have never found my blackboy to err in his statements or reports; and, moreover, he spoke to me about this animal many months previous, when going overland to Melbourne with sheep. Some

bones were picked up in a native camp near where Jerry had seen this 'bunyup,' which were collected by Dr. Tate; possibly these may throw some light on the mysterious animal found in these scrubs; the bark bearing the two toe-marks was also secured, but this, I fear, will not assist the solution of the mystery very much."

EXTRACTS FROM A LETTER SENT TO MR. CUMBRAE-STEWART BY DR. TATE, NOW RESIDING AT
PEAK VALE, NEAR CLERMONT, QUEENSLAND.

"It will give me great pleasure to impart what information I possess regarding the bones of the Tree-kangaroo found by us at the head of the Bloomfield River.

Extract from my Diary.—"Sept. 30th, 1872. Camp 53.—. . . Jerry wandered into the bush near the camp, and soon returned with the news that he had come across a strange animal. His description was such that we could scarcely believe him. He said that it was as large as a wallaby, and moved with the same hopping motion of the hind legs. When he first saw it, it was on the ground, but it quickly took refuge in a tree, and thence passing to others was soon out of sight. Jerry is a native of Hinchinbrook Island, and he told us that he had often heard of it from the mainland blacks, who called it Brungari.

"Oct. 30th.—Hann and I at daylight ascended the spur with Jerry where he had seen the strange animal. We were not so fortunate as to come across one, but the blackboy showed us the track-marks on several of the trees. We found an almost perfect skeleton, which I brought back to camp, though Hann demurred at my taking such rubbish. . . .

"They proved, on examination, to be not those of a wallaby, but to be the remains of an animal quite new to the whole party. The bones were packed as securely as possible, for I regarded them as of special value. Unfortunately, we soon got into a very tight corner, and were unable to advance much, sometimes not more than half a mile a day. The horses became very weak, so Hann had to sacrifice nearly the whole of Norman Taylor's geological collection, much of the ammunition, etc., and the bones."

"It was not until many years had elapsed that I again came upon the animal. In 1894, when I was in Cardwell, the blacks brought in a live Brongarry and gave it to Senior Constable MacManus, who brought it to me to know what it was. We did all we could to keep it alive, but without success. The constable claimed the skin, but gave me the body. Subsequent examination of the bones led me to the conclusion that they were identical with those we had found on the Bloomfield."

An early reference to the presence of Tree-kangaroos in Queensland is found in the Proceedings of the Zoological Society of London for 1873, which reads as follows:—

"A letter was read from Dr. G. Bennett referring to the supposed existence of a species of Tree-kangaroo (*Dendrolagus*) in Northern Queensland, some such animal being well known to the blacks of Cardwell. . . ."

In 1885, when commenting on the work of Lumholtz and Collett, Dr. Bennett remarked as follows:—"You may recollect that in the 'Proceedings' for 1873 (p. 518) I mentioned the supposed existence of a Tree-kangaroo (*Dendrolagus*) in Northern Queensland, some such animal being apparently well known to the blacks of Cardwell, who report that it is a Kangaroo that climbs trees and leaves deep scratches on the bark. I heard of such an animal from many other sources when in Queensland."

Dendrolagus bennettianus was described by De Vis from the skin of an animal which was caught alive by a resident of the Daintree River. The author was very guarded in his account, and stated that "Were I warranted in proposing a name for this supposed species, I would at once yield to a desire to identify it by association with that of one of our oldest and most respected Australian naturalists, Dr. G. Bennett, who has so often insisted on the probability of *Dendrolagus* being indigenous to Queensland. Should it prove that the skin before us really represents a distinct species, I trust that the name *D. bennettianus* be the one conferred on it."

In 1888, De Vis described another species as *D. fulvus* in a newspaper, "The Brisbane Evening Observer," which he regarded as being distinct, but which Thomas (1888) thought to be probably only a variety of *D. lumholtzi*.

In 1894, Dudley Le Souef gave an account of a visit to the Bloomfield River District, and stated that on his return journey he brought back with him "six Tree-climbing Kangaroos, *Dendrolagus bennettianus*. Two unfortunately died a few days after leaving. On arriving in Brisbane, Mr. De Vis informed me that the tree-climbing Kangaroos I had were not *Dendrolagus lumholtzi*, but a new variety which he had described and named *D. bennettianus*, after the late Dr. Bennett." The two specimens which died were purchased by the Australian Museum, and the species was described more fully from them by Waite (1894), who also published an interesting account of the habits of the animal from information supplied to him by Messrs. G. and R. Hislop, of the Bloomfield River district.

In 1909, Beddard stated:—"A recently described species [Proc. Zool. Soc. 1895, p. 131] has been attentively studied in its native haunts by Dr. Lumholtz." The reference quoted is to a paper by Beddard himself "On the Visceral Anatomy and Brain of *Dendrolagus bennetti*," and it is obvious that his is a *lapsus calami* for *D. bennettianus*, because on p. 136 he says:—"There are altogether five species, the fifth, *D. bennetti*, having been lately described from specimens living in the Zoological Society's Gardens." In this he makes no mention of Waite's work on *D. bennettianus* (1894), giving the credit for the description of the species to Sclater (1895), who gave a figure and description of two specimens collected by Le Souef on his trip to North Queensland in 1893, and which were received by the London Zoological Society in exchange from the Zoological and Acclimatisation Society of Victoria. In any case the reference is misleading, because Lumholtz studied a different species, *D. lumholtzi*.

We might observe that *D. lumholtzi* was originally collected on the Upper Herbert River, which is behind Cardwell, in the Rockingham Bay District. It was in this locality that Bennett asserted that a Tree-kangaroo existed. De Vis' specimen came from the Daintree River, which lies to the north of Port Douglas. The Upper Bloomfield, where Hann and Tate made their discovery, is near Cape Tribulation, and is situated north of the Daintree, and a short distance south of Cooktown, consequently we may safely assume that these explorers were the first to make known the existence of the Tree-kangaroo which was eventually described as *Dendrolagus bennettianus*, De Vis.

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RESCUE OPERATIONS ON THE MURRUMBIDGEE RIVER.

By H. K. ANDERSON, Inland Fisheries Officer. (By permission of the Under-Secretary.)
Communicated by A. R. McCulloch.

WHENEVER a flood occurs in the Murrumbidgee River and the waters approach what is known as the critical danger level, practically all the outer channels of the river are filled with water. These channels, variously called creeks, lagoons, billabongs, and ana-branches, traverse the low-lying river flats in all directions, the network of water-courses extending in some localities on one or other side to a width of several miles from the river bank. When the flood recedes, much of the water left in the creeks soaks away, leaving chains of water holes of varying depth. Some of these are almost permanent, but the majority dry up within a couple of months after the flood has ceased flowing through them.

All these waterholes teem with fish life, but the number of fishes, shrimps, yabbies and insect life they contain can hardly be realised, except by those who have seen a fine-mesh net drawn through such waters and observed for themselves the incredible number of living creatures they contain.

Should a flood as described above occur in the months of November and December, during, or just after, the general spawning season of the Murray Cod, Golden Perch and other food fishes, the helpless fry of these kinds are carried along by the waters and scattered broadcast over the river flats. If the waters recede quickly and cease to flow through the outer channels by the middle of January, countless numbers of little Murray Cod, Golden Perch, etc., are trapped in the waterholes described above, and millions of them perish year after year as the waters evaporate or soak away from them. If, on the other hand, the flood waters continue to flow through the creeks and billabongs until the middle of February, or a second flood follows within that time, most of the fry of the edible fishes have by then grown strong enough, and developed sufficiently the instinct of self-preservation to swim out of the shallow creeks into the permanent water of the deep lagoons or the river itself. It is, however, only at very wide intervals that the fish are released in this manner.

In the Riverina the winter rains of 1917 continued well into November, and, as a consequence, the Murrumbidgee River at Bringagee was running far over the level of its banks from the middle of September until about the middle of December, while its waters were frequently replenished by freshets from the mountains towards its source.

The collection of immature food fishes from overflowed lands and their transplantation in permanent waters is probably the most economical method of providing unstocked or depleted waters with a prospective fish food supply, and funds being available for this work, I pitched my camp on the bank of the Murrumbidgee at Bringagee, in which locality the river banks are low, and the area covered by flood water on either side is considerable. Our equipment comprised a motor lorry, single-seated runabout car, two 18-foot pulling boats fitted with outboard engines, horse and sulky; three nets $\frac{1}{2}$ " mesh, with a very deep bunt or bag heavily leaded and a frame on four legs, like an ambulance stretcher, with canvas water bag 4 feet by 2 feet by 1 foot deep for carrying live fish in the lorry or boats, two large galvanized wire gauze cages, 6 feet by 3 feet by 2 feet deep for storing the captured fish in the river, and a number of live-fish carriers for carrying consignments by rail. The staff consisted of five men, two boys and myself,

Whenever practicable, travelling was done by water for the reason that the roads were frequently made impassable for the motors by rain. The boats, one loaded with men and the other with nets and gear, were driven as close as possible, and the paraphernalia then carried across to the lagoon or waterhole about to be worked.

Most of these waters contain more or less fallen timber, which must, of course be removed before a net can be drawn through. In many cases this can be performed with the aid of rubber high boots without getting wet, but it is frequently necessary to get right into the water and attach a hauling line to the logs which can then, as a rule, be easily removed. Many of the waterholes to be netted are less than 20 feet wide and perhaps 18 to 24 inches deep, and it is from such places that the most valuable hauls of fry of edible fishes are obtained.

Light poles, about 5 feet long, are attached to each end of the net in order to keep the wings well spread. The ends of the net are now carried round the edge of the water as far as they will reach, then the end poles are carried along perpendicularly with the bottom dragging in the mud close to the edge of the water. This gives the net a full spread and no fish are able to double back. Meanwhile the sticks, leaves and rubbish are cleared away at the further end of the waterhole to make a convenient landing place, and the net is slowly drawn right through and up the bank until the end of the bunt is clear of the water. The canvas stretcher has been conveniently placed and filled with water in readiness to receive the fish. Each man is provided with a vessel of some description full of water, in which he collects all the edible fishes within his reach. The fish are then rinsed in a small dip net and transferred to the stretcher. This precaution is necessary, as the net frequently comes out full of silt and mud.

From some small waterholes more than 1,000 Murray Cod and Golden Perch, up to about 3 inches in length are collected, also a number of Macquarie Perch, Blackfish, Catfish, with an occasional Silver Perch and some adults of each species. The first haul of the net usually collects most of the miniature fishes—Gudgeons of several kinds, Pigmy Perch, Midget Perch, Smelts, Atherines, Hardyheads, Galaxias, etc. The second haul usually brings forth Murray Cod and Golden Perch, Shrimps, Yabbies, Insect larvæ, River Blackfish, Purple-striped Gudgeon, and Carp, and, as a rule, is the most productive of edible fishes, for by this time the water is more or less discoloured and the depressions in the bottom of the pond are somewhat levelled off by the weight of the net and its contents passing over them. The little Murray Cod and Golden Perch take advantage of every scrap of shelter. They hide under sticks, leaves, pieces of bark, in depressions made by the hoofs of stock, under roots, etc., and it is practically impossible to net them all out of a pond.

The accompanying photographs (Figs. 1 and 2) illustrate a typical waterhole which has been reduced by drought from a depth of nearly 5 feet to 12 inches of water. No. 1—About to be netted, and No. 2—The result of the first haul of the net. This waterhole was perhaps 60 feet long and 20 feet wide with about 12 inches of water over 18 inches of soft silt in the deeper portion, and proved to be literally teeming with life. Before operations could be commenced a great heap of drift timber was taken out of it.

The first haul of the net brought out an almost incredible number of living creatures. Upwards of 1,000 fish of edible kinds were counted from the net, and several hundred common Carp were thrown out on the bank. The whole contents of the net were then carefully lifted into a stretcher containing water, carried across to the Murrumbidgee River and liberated there. The whole catch would have easily filled 10 kerosene buckets, and two trips had to be made with the stretcher to convey all the fish to the river.

It will be readily understood that only a small percentage of the edible fish brought up in such a haul of the net could be collected for transplantation. The greatest expedition must be used in getting



Fig. 1.



Fig. 2.

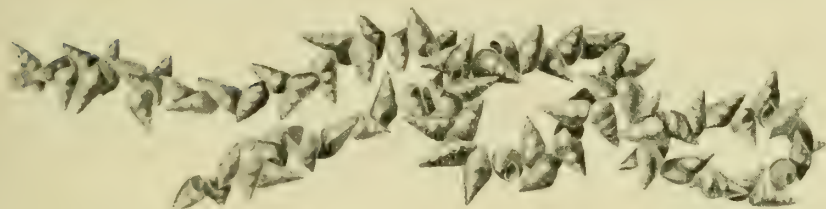
them into water again, otherwise the mortality would be very heavy. Each haul was therefore roughly picked over for about five minutes, and the remaining contents of the net, edible and inedible kinds together, carried away quickly to permanent water.

The approximate number of edible fishes rescued as above and transplanted in Burrinjuck Reservoir, in May and June, 1918, was 30,000 small fry, also 1,685 mature fishes, viz., Murray Cod, Golden, Silver and Macquarie Perch, River Blackfish and Catfish, and the approximate number of fishes of the same species rescued and released in permanent waters was 46,000 immature and about 2,000 fish over 10 inches in length, also many hundreds of thousands of the miniature kinds described above.

NOTES ON THE KELP SHELL, *CANTHARIDUS IRISODONTES*.

By ERNEST MAWLE

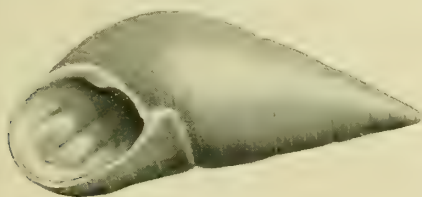
(Communicated by Charles Hedley, F.L.S.)



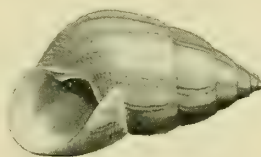
A Shell Necklace.

As mementoes of their visit to Tasmania tourists often purchase at Hobart necklaces of sea shells—dainty, glittering trinkets of rainbow colours. The beauty of these shells attracted the admiration of even the aboriginals, and a portrait of a native girl, wearing a necklace of them, has been left by Peron. The savages are said to have brightened their shells by burying them with seaweed. Probably an acid produced by the decaying plants dissolved away the exterior of the shell and exposed the brilliant under surface.

These shells have been popularly called "Kelp Shells," because they inhabit the fronds of sea weed. There are two kinds, a larger shell, *Cantharidus eximius*, which was used by jewellers as a knob for ladies' hat pins, and a smaller one, *C. irisodontes*, the necklace shell, properly so called. *C. eximius* prefers the giant kelp, *Macrocystis*, but *C. irisodontes* usually avoids that plant and chooses rather to dwell on the various smaller algae, such as *Sargasso* and *Eklonia*. It ranges from low water down to five fathoms, but is most plentiful at a depth of eight or ten feet. But a large variety of *C. irisodontes* has taken to living on the giant kelp. It is distinguished from *C. eximius*, whose home it shares, by being only half as large and by being smooth instead of spirally grooved.



Cantharidus eximius.



Cantharidus irisodontes.

The shells of *C. irisodontes* are gathered for the market about March, when they are in the best condition. A pole, ten to fourteen feet long, armed with a knife, or with two prongs arranged like a Canterbury hoe, is used to tear up the weed. The bunches thus pulled up are lifted into the boat and sharply shaken over a sheet spread across the bows. The shells drop off the weed onto the sheet, and are afterwards thrown into a basin of fresh water to kill and wash them.

An active collector can obtain nine quarts of shells a day. The price paid for them varies from 2s. 6d. to 4s. a quart, according to their size and lustre. Parrot fish search the sea weed and eat immense quantities of *C. irisodontes*. In January and February, when they are most abundant, the stomach of every parrot fish is full of their broken shells.

The span of life of *C. irisodontes* appears to be about a year. Young shells first become visible on the weed in January or February, but these have obviously been hatched several weeks previously. Some localities are more forward than others. In March they are half grown, reaching a length of 4 mm. and numbering six whorls. By the end of April in Port Arthur the shell has attained its full size, 11 mm., and has altered considerably in contour, the base having become narrower in proportion to the length. By July and August the shell has been eroded or defaced by various incrustations; the earlier whorls, from which the animal has withdrawn, have also decayed and crumbled away. The old shells disappear about October.

The shells vary greatly in different localities. In some parts of Port Arthur they are solid, yet in other beds scarcely a mile distant, they are so thin as to be not worth picking. Most of those from Fortescue Bay are too thin to be used. Recherche Bay produces a long, narrow and unusually heavy shell, which commands a high price. Shells of the finest lustre come from Black Jack, in the north of the Tasman Peninsula.

Shells are cleaned of animal matter by macerating them in water and allowing flies to work on the decaying mass. If insufficiently cleaned, a black speck appears at the tip. The first process in the manufacture of the necklaces is to grade the shells into sizes.

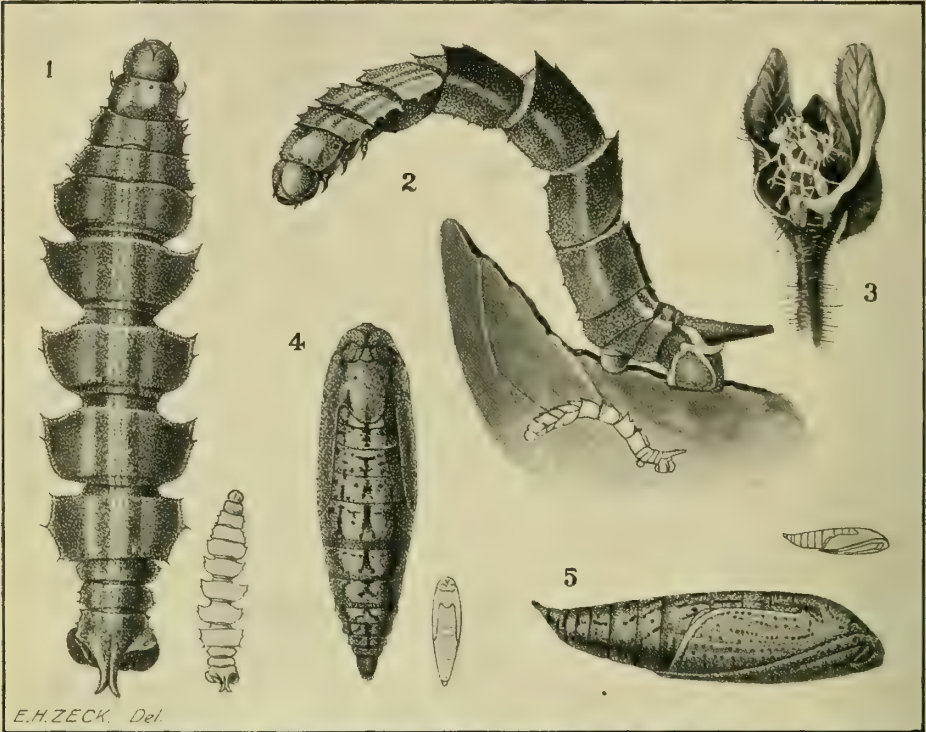
The outer coat of the shell resists the penetration of dye. It may be removed by the agency of lime or of acid. In the first case, chloride of lime is moistened with water till reduced to a thin paste. In this the shells are mixed, the mass is well stirred and left to soak for several hours. The shells are then removed, washed clean, and the under surface is found to be exposed in a glossy condition.

When acid is employed, that material is economised, and the lustre of the shell improved, by using it hot. To one gallon of boiling water three ounces of muriatic acid are added. The shells are enclosed in a net bag, dipped and well shaken in the solution. Lest the acid should eat too deeply, the bag should be withdrawn from time to time and the contents examined. When the etching of the acid has gone far enough, the bag full of shells is transferred to another vessel and thoroughly washed in soap and water. This water must be tepid, for cold water would injure the nacre by cracking it.

The shells are then strung. They are sold in their natural colour, or their appearance may be varied by staining with aniline dyes of assorted shades. The dye is applied hot and in a net bag.

A standard necklace is thirty-six inches long, with an average of eight shells to the inch, and a weight of two ounces. When composed of the small shells, known to the trade as "gems," a necklace may be as light as half-an-ounce.

These Hobart necklaces not only supply the Australasian market, but are exported abroad.



Eucyclodes metaspila, WALKER.

NOTES ON THE LIFE-HISTORY OF AN EMERALD MOTH, *EUCYCLODES*

METASPILA, Walker.

By E. H. ZECK.

(Plate XIII.)

THE curiously-shaped larva, illustrated on the accompanying plate, fell from a bush of *Angophora cordifolia* which was shaken over an open umbrella at Como, New South Wales, in January, 1918. As it lay perfectly motionless where it fell, it closely resembled a broken or partially-eaten fragment of the young foliage. Its light reddish colour, combined with the lighter dorsal markings, harmonised so well with that of the young leaves of its food-plant that it could only be detected with difficulty when replaced upon them.

This specimen was kept alive in captivity with some branches of the *Angophora*, and bred out, while the accompanying drawings of it were prepared as it passed through its various stages. It was about full-grown when first secured, and commenced to spin a cocoon three days after its capture; it pupated two days later, and finally emerged as an adult moth after a further space of nineteen days. For the identification of the moth I am indebted to Mr. George Lyell.

Family GEOMETRIDÆ.

Subfamily GEOMETRINÆ.

EUCYCLODES METASPILA, Walker.

Description of the larva, three days before pupation. (Pl. XIII., figs. 1, 2.). Light reddish brown in colour. The dorsal surface with three lighter, longitudinal markings, which become gradually less distinct anteriorly and posteriorly. Two narrow darker lines extend along the length of the median longitudinal band. Upper surface darker than that of the under, and with two lighter longitudinal bands of colour, which gradually become less distinct towards the extremities of the body. The entire larva has a shagreened or granular appearance, with here and there small protuberances.

The spiracles have the appearance of small black rings, and are situated as follows: Dorsally and near the posterior lateral margins of the first thoracic segment; ventrally and near the anterior lateral margins of the first abdominal segment; dorsally and near the anterior end of the second, third, fourth and fifth abdominal segments; sub-dorsally and near the lateral margins of the sixth, seventh and eighth abdominal segments.

Head small and rounded. All the segments, excepting the sixth, seventh and eighth abdominal ones, are almost flat dorsally, being but slightly raised in the centre, and at the lateral edges; these segments are rounded in the centre ventrally, but slope sharply away to the lateral edges, which are quite thin. Each thoracic segment bears a pair of small legs ventrally. The sixth and seventh abdominal segments are much smaller than the others, and are not flattened dorsally. The sixth abdominal bears a pair of pro-legs. The eighth segment bears a pair of claspers. Above these the dorsal surface is produced backward into a fleshy tubercle, which divides at its extremity, the two ends diverging laterally.

- *Dimensions of the full-grown larva*.—Length, from the head to the anal claspers, 29 mm.; width across the second abdominal segment, at the widest part, $7\frac{1}{4}$ mm.; at the intersection of the second and third abdominal segments, $3\frac{1}{2}$ mm.

On the 29th January, three days after its capture, the larva commenced to spin a loose cocoon amongst the topmost shoots of the young foliage. This cocoon (Pl. XIII., fig. 3) consisted of small pieces of leaf held together by coarse silken strands. After finishing the cocoon, it remained in the larval form for two days before pupating. The pupa attached itself by means of small hooks on the anal segment to a small wad of silk, at the base of the cocoon, and remained in an upright position, the anterior end being uppermost.

The pupa (Pl. XIII., figs. 4, 5) is similar in colour to the larva, but has three narrow, darker coloured broken bands along the dorsal surface, instead of three lighter ones as in the larva. The whole of the pupal shell has the same granular appearance as in the larval form. There are a number of small black spots scattered about it, more particularly on the slightly raised wing venation and along the sides of the antennæ. At the end of the posterior segment are a number of small hooks which are attached to the wad of silk upon which the pupa stands whilst in the cocoon. Length of the pupa, 16 mm., width $4\frac{1}{2}$ mm.

Imago (Pl. XIII., fig. 6).—Upper surface of the moth green in colour. Costal margin of the fore-wings and the fringes of scales around the outer margins of both wings light reddish brown. The costal margin of each fore-wing has small, lighter, transverse markings. The outer edge of the integument of each wing is marked with a more distinct whitish colour, which broadens out at the termination of each vein. Fore wings with two narrow, yellowish, wavy, transverse markings. Hind wing with only one wavy marking, continuing in line with the outer transverse marking on the fore wing. Scattered about the upper surface of both wings are a number of small and somewhat indistinct, yellowish markings. Beneath: wings white, tinged with green. Antennæ and palpi light red. Eyes black. Upper surface of the thorax with a light reddish marking in the centre. Anterior end of the abdomen with small light reddish spots in centre of each segment, above which change into white at the posterior end and become broader backwards, so that the last two segments of the abdomen are completely white. Beneath the abdomen is silvery white. Pro-thoracic legs pink, the under surfaces of the femur and tibia white. Meso- and meta-thoracic legs white. The reddish and brown colouration of portions of the adult moth are similar to those present in the larval and pupal stages.

The moth emerged on February 19th, nineteen days after pupation. Its width across the expanded wings is 35.5 mm., and the length from the head to the tip of the abdomen, 14 mm.

The following notes on the rearing of another specimen of this species, were very kindly given me by Mr. C. H. Wickham, of Leura, New South Wales, who has had considerable experience in the rearing and breeding of Australian moths.

"A larva, 10 mm. in length, was taken at Newport, on 20th May, feeding on the young leaves of the Red Gum, *Eucalyptus*. When fully grown it was 29 mm. in length and 3 mm. in width at the intersection of the segments. The colour was at first dark brown, but it changed in June and again in July and August, becoming much redder, with light coloured lines along the dorsal and spiracular surfaces. It changed colour again in September to a buff shade dorsally, and became much darker ventrally. The head was very small and brown. The thoracic legs and one pair of pro-legs were brown. The first to the fifth abdominal segments were expanded outwards dorsally, to points, which gave the larva a dead fern leaf appearance. The projections on the third segment were broadest, and the others decreased anteriorly and posteriorly. On the dorsal surface of the eighth segment was a small, fleshy tubercle, inclined towards the anal end, and on the segments and tubercle were small floury-looking lumps. This larva fed in an exposed position during the day. It pupated in a fairly loose web, with leafy fragments around the cocoon on the surface of the ground, on September 17th.

The pupa was 15 mm. in length and 4 mm. in width. The head and thorax were covered with a whitish powder, and the colour was brown with one dorsal and two sub-dorsal darker lines. It had a blunt spine, with side flukes at the anal end. Hatched from egg on or about 1st May. The adult moth emerged on the 31st October."

Mr. Wickham also states in his notes that "the larva changed colour at different stages," and that although he has watched very closely, he has never seen a true Geometrid cast a skin, but has often seen them change to a distinct colour. "The larva does not vomit, and is very difficult to find, except when shaken from bushes."

It will be noticed that in the pupa bred by me (Figs. 4, 5), the tip of the abdomen is only a flattened segment, at the end of which are a number of small curved hooks. Although when viewed from the side it has the appearance of a spine, it does not possess the side flukes which Mr. Wickham mentions as being present in his specimen.

Mr. Geo. Lyell informs me that "the male is rather smaller than the female here figured, and has obscure white dots on both wings, with only the faintest traces of the reddish margins and spots." He also states: "The strange form of the larva is not a surprise, for three at least of these 'Emeralds' have still stranger forms. Both *E. meandraria* and *E. boisduvalaria*, which are southern species, have wide flanges to many of the segments; they both feed on the *Melaleuca*. Beating the boughs above an upturned umbrella is the likeliest way of coming across the larvæ, and the probability is they are night feeders. As far as I know they all go into the earth to pupate here in Victoria; but in the warmer climate of New South Wales more of them may pupate above ground. There are probably nearly a hundred species of these 'Emeralds' described from Australia, and many of them are taken around Sydney."

EXPLANATION OF PLATE XIII.

Eucyclodes metaspila, Walker.

Fig. 1.—Dorsal view of a full-grown larva 29 mm. long.

Fig. 2.—The larva in a characteristic resting attitude.

Fig. 3.—The loose cocoon in a young shoot of *Angophora cordifolia*. Natural size.

Fig. 4.—Dorsal view of the pupa.

Fig. 5.—Lateral view of the pupa.

Fig. 6.—The adult moth. (Female.)

The small figures in each case represent the actual size of the specimens. The figures of the larva and pupa were drawn from the living specimens.

**STUDIES IN PHLEBOTOMIC DIPTERA, No. 1. NEW SPECIES OF SIMULIDÆ
AND CHIRONOMIDÆ.**

By **FRANK H. TAYLOR, F.E.S.** from the Australian Institute of Tropical Medicine,
Townsville.)

(Figs. 1—3.)

THE sand-flies have, in the case of the Simuliidæ, been greatly neglected in Australia. There have been described, so far, only two species, *S. furiosum*, Skuse, and *S. victoriæ*, Rouband.

I am now enabled to add another species, thanks to the courtesy of Dr. T. L. Bancroft, who kindly presented a series of dried specimens and also some preserved in alcohol to the Institute.

The Chironomidæ are somewhat better represented, as seventy-six species, distributed in seventeen genera, have been described to date, mainly by Skuse in 1889.

Two new species are described in this paper—one of which was taken by Dr. J. H. L. Cumpston, Director of Quarantine, and kindly presented to the Institute by him. The other was taken by my colleague, Dr. W. J. Young.

The type specimens are contained in the Institute collection.

Fig. 1



Fig. 2

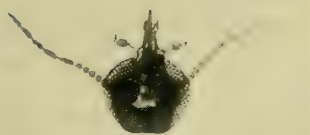


Fig. 3

Family SIMULIDÆ.

SIMULIUM BANCROFTI, *sp. n.*

(Figs. 1 and 2.)

♀. *Head* black with grey tomentum; front with a well-defined median groove; palpi black with black and pale pubescence, first joint pale, apex of second narrower than base, third strongly emarginate on the inner side towards the apex, fourth long, thin, cylindrical; antennæ nine-jointed, first two brownish, first shorter than second, latter about the length of the third, third to the apex black, third broadest and about twice the length of fourth; proboscis black, apex with short, stout pubescence; eyes coppery.

Thorax: Black, tomentum grey, pubescence pale; pleuræ black with grey tomentum.

Abdomen: First segment deep black, two to six deep black with median apical ash-grey spots, small on the second and increasing in size to the sixth, which is ash-coloured, except for a narrow basal and lateral margin of deep black, seventh ash-grey, with a narrow lateral deep black border, eighth ash coloured, third to fifth also with apices of sides ash-coloured, pubescence black, pale on the pale areas; venter grey with grey pubescence. Halteres pale creamy.

Legs: Dark yellowish-brown, tibiæ dark brown above, anterior tarsi black, except base of first yellowish-brown, mid and posterior tarsi yellowish-brown, second to fourth with their apices dusky, first posterior tarsi dusky beneath; pubescence pale; apex of tibiæ with a stout spine; apex of first posterior tarsi produced into a terminal expansion overlapping the second tarsals beneath.

Wings: Clear, pale yellowish at the roots; costa auxiliary and first long veins paler than roots, remaining veins almost indistinguishable from wing membrane.

Length, 2 mm.; length of wing, 2 mm.

Hab.—Q.: Eidsvold (Dr. T. L. Bancroft).

The wings, legs and abdominal ornamentations render this species abundantly distinct from *S. furiosum*, Skuse, and *S. victoriæ*, Rouband. It resembles *S. jolyi*, Rouband, from New Hebrides, in having an apical terminal expansion on the first posterior tarsi.

It affords me much pleasure to dedicate this species to its discoverer.

SIMULIUM FURIOSUM, *Skuse*.

Proc. Linn. Soc. N.S. Wales, xiii., p. 1365, 1888 (1889), pl. xxx., fig. 1.

A specimen, on a card, presented to the Institute by Dr. Ferguson, may possibly be this species, but it is in a very poor state of preservation and is more or less covered with gum, which has obscured details, thus rendering its determination indefinite.

Hab.—N.S.W.: Narramine (Dr. Ferguson).

Family CHIRONOMIDÆ.

CULICOIDES TOWNSVILLENSIS, *sp. n.*

(Fig. 3.)

♀ *Head*: Black, with golden pubescence; antennæ blackish-brown, apex of last joint nipple-like, pubescence dark; palpi dark brown, pubescence pale, first two segments longer than third and fourth together, second segment strongly emarginate on its inner edges, first segment with a distinct notch on the outer edge of the basal third; eyes black.

Thorax: Dull black, with fairly dense lemon coloured pubescence, scutellum similar; pleuræ black. Halteres with orange coloured knobs.

Abdomen: Black, with dark brown pubescence; venter brown.

Legs: Femora brown, tibiæ and tarsi yellowish-brown, pubescence pale, fairly long on the femora, mid tibiæ about two and a half times the length of first tarsi, posterior tibiæ about twice the length of first tarsi.

Wings: Longer than abdomen, clear, covered with brown pubescence; costa, first and second longitudinal veins brown, the latter reaching the costa considerably in front of the base of the fifth longitudinal fork.

Length, 1 mm. (vix); length of wing, 1 mm.

Hab.—Q.: Townsville (Dr. W. J. Young).

Described from five specimens taken during the morning while biting. It appears to be most nearly related to *C. minusculus* (Skuse), but is readily distinguished on venational characters alone.

CULICOIDES MULTIMACULATUS, *sp. n.*

♀ *Head*: Black, pubescence pale; antennæ with scape, black, prominent, pedicel yellowish, longer than following joint and about twice as wide, next seven joints pale yellowish-brown, remainder brown, the apical longest, stout, and ending in a blunt point; proboscis and palpi dark-brown, the latter with the second joint swollen, pubescence black.

Thorax: Black, with brown tomentum, sides with grey tomentum not reaching the shoulders, with a brown spot superimposed in front of the wing roots and two large grey ones in the centre of the thorax; pubescence pale; scutellum black.

Abdomen: Black, with faint grey tomentum, pubescence pale, scanty.

Legs: Brown, femora and tibiæ with a subapical pale ring, pubescence black; fore tibiæ about once and a half the length of the first tarsals.

Wings: Brown, longer than thorax and abdomen, with fourteen clear spots, the largest situated behind the apex of the first long vein; veins brown; first and second long veins reaching the costa considerably in front of the base of the fifth longitudinal fork; pubescence black, fairly dense.

Length, 1.5 mm. (vix) ; length of wing, 1.75 mm.

Hab.—Victoria : Portsea (Dr. J. H. L. Cumpston).

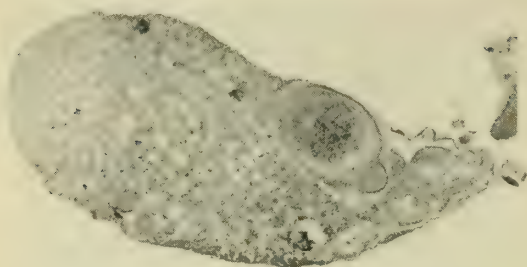
This species is more nearly related to *C. marmoratus* (Skuse) than to *C. molestus* (Skuse), the only two known southern forms with spotted wings. It may, however, be distinguished by the spots being more numerous and irregular in size while they appear to be more regular in size in *C. marmoratus* and *C. molestus*. It also differs in thoracic ornamentation.

EXPLANATION OF FIGURES.

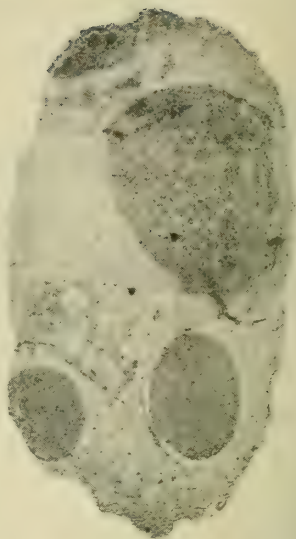
Fig. 1.—*Simulium bancrofti*, sp. n., head.

Fig. 2.—*Simulium bancrofti*, sp. n., posterior leg.

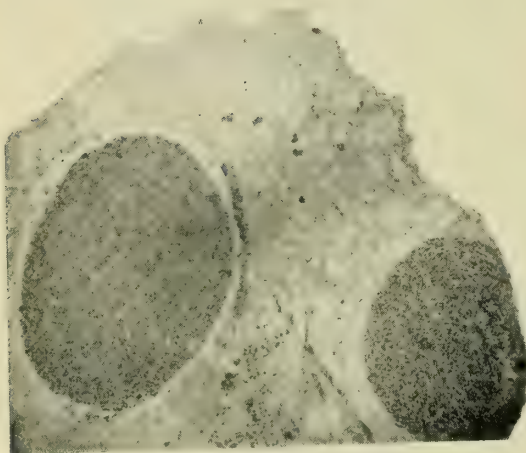
Fig. 3.—*Culicoides townsvillensis*, sp. n.



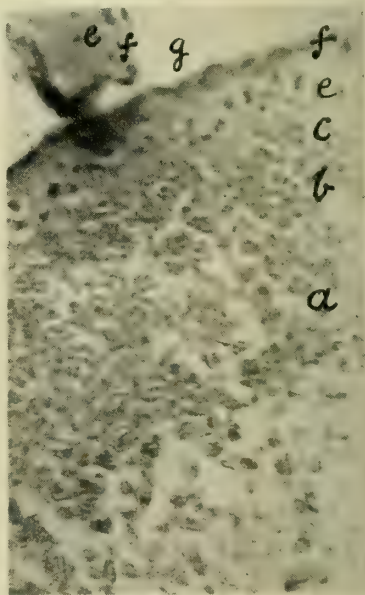
A



B



C

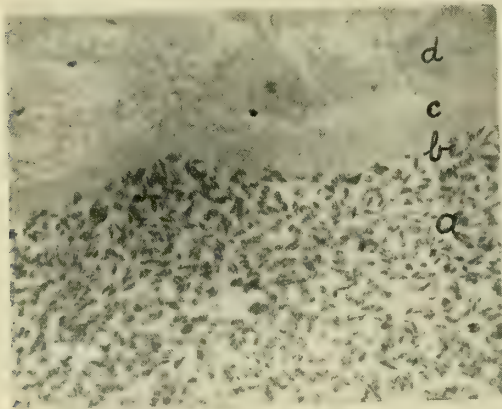


d

c

b

a



E

A PARASITE, *MYXOBOLUS HYLAE* Sp. Nov.. OF THE REPRODUCTIVE ORGANS OF
THE GOLDEN SWAMP FROG, *HYLA AUREA*.

By T. HARVEY JOHNSTON, M.A., D.Sc., and M. J. BANCROFT., B.Sc., Walter and Eliza
Hall Fellow in Biology, University, Brisbane.

(Plate XIV. ; text figs. 1-5.)

A NUMBER of Golden Swamp Frogs, *Hyla aurea*, which were received from Sydney during 1915 for dissection purposes in this laboratory, were found to have their genitalia infested by a species of *Myxobolus*. This material forms the subject matter of the following paper, though in addition to some preparations made at that time, we have also others made many years previously in Sydney.

The first to record the occurrence of this parasite was A. W. Fletcher, who presented a paper to the first meeting of the Australasian Association for the Advancement of Science in 1888, an abstract of which was published in its Report. Fletcher used the wide term "myxosporidium," but his descriptions leave no doubt that he was dealing with the same organism as we are discussing. The parasite was observed in a considerable proportion of the male frogs dissected in the Biological Laboratory of the University of Sydney, and was observed in one species only, *Hyla aurea*. It was said to have been found also in the urinary bladder under the peritoneum of both males and females, as well as in the testes. Fletcher aptly described the appearance of the infected part as presenting "a large oolitic mass of encysted myxosporidia," and he gave a short account of the spores which he described as closely resembling those of a species occurring encysted on the gills of cyprinoid fish. Several intermediate stages in the development of the spore were observed.

The myxosporidium which Professor W. A. Haswell (1890, p. 661) mentioned as being common in *Hyla aurea* is obviously the same parasite. The only other records of this protozoon were made by one of us (T. H. J., 1909) who referred to *Myxobolus* sp., a sporozoon infesting and destroying the genital organs of *Hyla aurea* in Sydney, and by Cleland and Johnston (1910) in their paper on the "Haematozoa of Australian Batrachians," where mention was made of its occurrence in that frog in the Sydney district. *H. aurea* does not occur in south-eastern Queensland, but is extremely common in the neighbourhood of Sydney.

The parasite is an interesting one, being the first member of the family Myxobolidae to be recorded from an amphibian host. Representatives of each of the other families of Myxosporidia are known as parasites of Amphibia. In addition, a microsporidian, *Plistophora danilewskyi*, Pfeiffer, has been recorded from the foot-muscles of a European frog, *Rana temporaria*. We append a list of Myxosporidia known to infest members of the class Amphibia.

Labbé (1899, pp. 87-95) mentions:—

- (1) *Leptotheca ohlmacheri* Gurley, as occurring in the kidney and ureters of *Bufo lentiginosus*, *Rana esculenta*, and *R. temporaria*.
- (2) *Cystodiscus immersus* Lutz (= *Sphaeromyxa immersa*), in the gall bladder of *Bufo marinus* and *Leptodactylus ocellatus*—both Brazilian batrachians.

(3) *Chloromyxum caudatum* Thélohan, from the gallbladder of *Molge cristata*.

Aurebach (1910, p. 44) refers to the same three species, but omits *Rana esculenta* as a host for *L. ohlmacheri*. He adds a fourth, namely:—

Chloromyxum protei Joseph (1905, 1906), from the kidney of *Proteus anguineus*.

Müller, in 1895, referred to the presence of "Myxosporidia" in tumours in the skin of *Rana temporaria* (see Labbé, 1899, p. 113).

Doflein (1911, pp. 871 and 875) merely mentioned the occurrence of members of Polysporea and, doubtfully, of the Dispora in Amphibia.

Mode of Occurrence.—The infected frogs appear sickly and emaciated. In the male the testes and vasa efferentia are attacked, while in the female only the oviducts have been found to harbour the parasite. The disease is much more common among males. In a batch of about thirty *H. aurea*, every male frog (seven) and two females were parasitised (April, 1915). In cases of heavy infection the whole testis is swollen and studded thickly with white cysts, which may be imbedded in the tissue of the organ or may project freely into the coelome. The largest cysts are 2-3 mm. in diameter, but all sizes, down to those of microscopic dimensions are to be found. Each cyst when crushed exudes a milky fluid, which proves on microscopic examination to be composed of myriads of tiny spores. Small cysts and loose spores may be found in the efferent ducts, but no spores have yet been detected by us in sections of the kidney tubules. Fletcher found the parasite also in the urinary bladder of both sexes. As no fresh material was available for the present work, and as only the genitalia of the diseased specimens were preserved, we are unable to confirm his observation.



Fig. 1.—Transverse section of a heavily infested testis.



Fig. 2.—T.S. infected testis.

In one male specimen both testes and both kidneys were affected, and the upper parts of the ureters adjacent to the kidneys were swollen and milky in appearance. In another, in addition to the testes, the adjacent kidney and mesentery were attacked. In parasitised females, one or both oviducts were infested.

The Spore.—The spore consists of an outer resistant shell or envelope, and an inner protoplasmic body. This envelope is bivalved, the two valves forming a slightly thickened rim where they meet. When lying on its flat surface the spore appears as an oval or sometimes more or less egg-shaped body.

There is a considerable variation in size, but the average dimensions are: Breadth 8-10 μ , thickness about 6 μ . Reduction in length is the commonest variation, some individuals being approximately circular, with a diameter of 7-8 μ . The thickness of the outer shell or envelope is about 1 μ . In some the envelope cell nuclei are visible at the posterior end of the spore. This perhaps represents a developmental stage.

At the anterior end are two prominent pear-shaped polar capsules, the average dimensions of which are 4-5 μ in length and 2 μ in breadth. Each polar capsule contains a fine, spirally-wound polar filament, which is extruded on application of acids or alkalis, and which, when fully extended, measures 90-98 μ in length.

The posterior portion of the spore is occupied by the protoplasmic body—the future sporozoite or amœbula. In the protoplasm there lies a relatively large iodophilous vacuole, about 2 μ in diameter. The nucleus is usually double; sometimes there are two distinct nuclei, while rarely only one is detected.

Sections of the kidney, testis, and oviduct were cut, varying in thickness from 1 to 7 μ . In regard to staining methods, Ehrlich's and Delafield's hæmatoxylin gave the best all round results, both for sections and smears, the various nuclei showing up well in some preparations. With Giemsa, differentiation was not so good. Carbol fuchsin acted as a differential stain for the spore; by overstaining



Fig. 3.—Spores of *Myxobolus hylæ*.

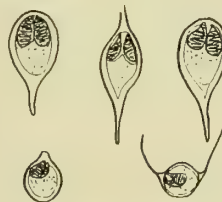


Fig. 4.—Abnormal spores.

and then washing out excess stain in acid alcohol, the host tissue was very faintly tinted while the spores showed up as bright pink. By using borax carmine and thionin the host tissue was stained pink, the spores alone taking the blue dye. The vacuole, polar capsules and threads, as well as the envelope, showed up well on treatment with tincture of iodine. Both Haidenhain's hæmatoxylin and picrocarmine gave unsatisfactory results.

In a section of an infested testis a large portion of that organ may be seen to be occupied by cysts. Each cyst is surrounded by a narrow, lightly-staining ring—the ectoplasm. Immediately within this is a denser, more or less granular layer containing developing spores, while within this again the cyst is closely packed with fully-developed spores. In the very small cysts few or no mature spores are distinguished. In sections stained with carbol fuchsin masses of spores may be noticed lying in the seminiferous tubules along with the sperms.

In a section of an infected oviduct, the cyst was observed to lie between the layers of the wall and to project into the lumen of the duct. It possessed the same structure as described above.

Stages in Development.—Cells with a single nucleus were fairly common in smears made from a cyst, and perhaps represented the young pansporoblasts. Cells with 2, 4, 6 and 14 nuclei were seen, and were probably stages in the development of the spores within the pansporoblast. Other larger cells, with prominent irregular nuclei and smaller, more deeply-staining chromatin masses in the cytoplasm, were also met with.

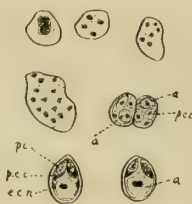


Fig. 5.—Some developmental stages: *a*, amœbula; *ec n*, envelope cell nucleus; *p c*, developing polar capsule; *p c c*, polar capsule cell.

Experimental.—In April, 1915, two infected testes were removed from a Golden Swamp Frog, *Hyla aurea*, and fed to two Green Tree Frogs, *H. carulea*. After three weeks, one was killed, but an examination of it failed to reveal the presence of *Myxobolus*; the other frog escaped. In November, 1915, cysts from a female *H. aurea* were fed to another *H. carulea*. After four weeks the latter seemed sickly and was killed, but no myxosporidia were detected within it.

The parasite is apparently specific in its associations, since it has not been observed in any frog other than *H. aurea*. Both *H. aurea* and *H. carulea* occur around Sydney; the former abounds in swamps, and is much more common than its larger tree-climbing relative.

It has already been pointed out by Cleland and Johnston that the latter harbours a blood parasite, *Lankesterella hylæ*, which has never been detected in the Golden Swamp Frog.

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EXPLANATION OF PLATE XIV.

- A and B.—T.S infected testes $\times 30$. In A the sporozoon cysts are situated towards the inner border of the gland, some actually projecting into an efferent duct.
- C.—Portion of section figured in B, showing two cysts with abundant spores, also numerous clusters of spores in the ducts of the testis. $\times 68$
- D.—Portion of the large cyst shown in B. Edge of cyst showing (a) mature spores, (b) granular zone, containing developing spores, (c) narrow ectoplasmic zone, (d) tissue of testis. $\times 200$.
- E.—Part of oblique section of oviduct. Lettering as in D; also (e) layer of large cells belonging to oviduct, (f) epithelium, and (g) lumen of duct. $\times 400$.
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ORNITHOLOGICAL NOTES.

(Edited by A. F. BASSET HULL.)

POWER OF FLIGHT OF THE BLACK-THROATED GREBE.—Much uncertainty appears to exist as to whether the Black-throated Grebe (*Podiceps novae-hollandiæ*) is able to fly. Recently I had the gratification of actually witnessing the flight of this species. Across the lagoon that runs past the town of Forbes, N.S.W., a footbridge is built. A group of Grebe, traversing the lagoon, rose with a rapid, though laboured flight, when they came to the bridge, reached an altitude of about fifteen feet, and settled again a few yards beyond the bridge—the total distance flown could not have been more than thirty yards.—E. A. BROWNHILL, Forbes.

[All three species of Grebe are capable of long and sustained flight. Like the Musk and Blue-billed Ducks, however, they do not exert themselves unnecessarily.—ED.]

NESTING HABITS OF ARTAMUS.—Whilst spending a holiday on the Monaro highlands, during the month of February, 1918, I was struck with the difference in the nesting habits of the Wood Swallow (*Artamus sordidus*) in that district, as compared with the Forbes district. In the latter, during the spring months, both *A. sordidus* and the White-browed Wood Swallow (*A. superciliosus*) nest in prodigious numbers, placing their nests in any position, no matter how exposed. Not so in the Monaro country. In every case I observed the nest was placed in a hollow spout at some height from the ground, and always facing north. Doubtless this position was chosen as a protection against the frequent cold, bleak, southerly winds so prevalent in the district.—E. A. BROWNHILL, Forbes.

LATE NESTING OF THE WHITE-PLUMED HONEYEATER.—On May 17th, on the banks of the Lachlan River, I discovered a nest of the White-plumed Honeyeater (*Ptilotis penicillata*), and naturally thought it was an old structure. On investigation, I found that it contained four fully-fledged young birds. This is surely a remarkable instance of late nesting?—E. A. BROWNHILL, Forbes.

[Many of the Honeyeaters, and notably the Bearded and Fulvous-fronted (*Meliornis novae-hollandiæ* and *Glyciphila fulvifrons*) breed just when it suits them. I have observed fresh eggs in the nests of both the last-named species near Sydney in ten out of the twelve months of the year.—ED.]

PELICANS AT LAKE COWAL.—The frequently-asked question, "Where does the pelican build its nest," was answered in the summer of 1916-17, when a breeding colony was formed at Lake Cowal, evoking considerable interest in the minds of bird lovers from near and far. The oldest residents in the Lake Cowal district had not known the pelicans to nest on this lake before. The breeding colony was established on two earth banks surrounded by the lake water, and about sixty chains from the edge. These banks were thrown up when a stock tank was made in the dry bed of the lake. As it partially filled, the banks appeared as two small islands, each approximately sixty feet square. Upon visiting this breeding colony, I found seventy young pelicans in various stages of growth, from the

chicken just out of the egg to the almost fully-feathered young bird. Several of the latter swam away with the old birds. When disturbed, the young pelicans huddled together in a restless, swaying mass, ejecting from their long bills scores of young fish, chiefly carp. During the year 1917 Lake Cowal waters rose higher, and submerged the breeding place, though by that time the young birds were all sufficiently grown to be safe on the water. The old pelicans established another colony on two other banks in October, 1917, and some eggs were laid, but the lake waters still rising, submerged this breeding place before the eggs were hatched. The old birds then made use of still another couple of tank embankments, about two miles distant, where they built fully seventy nests and reared many young birds. Some of the nests at this spot were washed away by the waves when strong winds prevailed.



Rounding up young Pelicans.

The nests generally were poorly constructed, mainly from lack of suitable material; usually only a few small sticks were arranged round the eggs laid on the ground. There were some few nests nicely lined with dead leaves and rushes. On this last-mentioned nesting place the eggs were hatched after 12th January, 1918. The birds at this particular colony got very quiet, and would allow parties of sightseers on horseback within thirty yards before leaving their nests. Only two eggs were laid in each of about one hundred nests that came under observation. Two nests contained three eggs each. In



For Taronga Park.

some spots the nests were so close together as to touch each other. Two graziers, who were accustomed to counting large numbers of sheep, counted the pelicans on the lake near the nesting colony; one made the number 604 and the other 596.

Some of the birds would fly towards and soar over the heads of any pedestrians or riders coming within sight of their breeding ground. One day, while watching the old birds on their nests after some had flown away, I saw one pelican deliberately toss two eggs into the water. It seemed to me at the time that these two eggs were from its neighbour's nest. Some of them certainly robbed their neighbours' nests of sticks to build up their own, when the more timid birds had flown away. Sometimes there was quite a clashing of long beaks in fight, the nests being so close together. A young cormorant, disturbed from its nest, tried to land on the pelican ground, but, after many ferocious thrusts from the old pelicans, it was glad to take to the water again. I discovered that it was possible to drive and muster the young pelicans on the water, and one day five men on horseback surrounded the young pelicans, drove them nearly two miles on the water, guided over thirty of them on to the land, and through a gate into a rabbit netting fence. Some of the largest of the young birds flew away when nearing the land, but sixteen were captured and sent to Taronga Park.—WILLIAM LOW, Cowal North, N.S.W.

MAGPIES KILLING QUAIL.—Recently while strolling through some paddocks we flushed several quail. One flew straight ahead and dropped near two magpies (*Gymnorhina tibicen*), one of which attacked the quail, which we rescued, finding it quite disabled, one wing being broken and a deep wound made in its head.—THOS. CHAS. BURNELL, Wollun, N.S.W.

WIRE NESTS FOR MAGPIES.—The magpies here frequently use tie-wire in the construction of their nests. They find scraps of the material along the fences, where it is used for fastening the rabbit-netting to the wires. Last season—in September, 1917—we had a very heavy fall of snow; large branches were broken from the trees all over the bush, and many unfortunate bird families lost their nests and their lives. Every magpie's nest discovered by my grandsons was composed, more or less, of wire. One piece—No. 16 gauge—was over 5 feet long. I should think that it required the united efforts of two magpies to coil it. Some of the nests contained shorter pieces of heavier wire, in some instances telephone wire, No. 12; but they must surely have found it already sufficiently bent for their purposes.—THOS. CHAS. BURNELL, Wollun, N.S.W.

THE SAGACITY OF BROODING BIRDS.—My first experience occurred while collecting at Brooklana, the Hoop-pine Park of Don Dorriggo plateau, on 9th January, 1914. Winding my way along the serpentine banks of the Bo Bo River, a most retired locality adjoining the Never Never, I observed a peculiar-shaped nest, suspended by shreds of dried moss to a single thorny arched spray of Lawyer vine. It was somewhat different in shape to the nests of a species of *Gerygone*, which hung rather plentifully in the vicinity, and appeared not unlike a semi-compressed *Ocarina*, with a bearded appendage below; the entrance spout, however, was placed at right angles to the vertical structure, and therefore completely hid the interior. The birds were invisible, so I ventured to insert my finger through the aperture. The moment I did so the young birds within began to chirp; then, like a flash, two small birds dashed from cover, flew past my face and disappeared in the dense scrub beyond. With the hope of securing a photograph of the unique nest, and possibly the parents at the entrance, I decided to mark the position and blaze my way out of the tangle. On my return with the camera about two hours later, I found that the bottom of the nest had been broken through, and the young birds were gone. I came to the conclusion that the parent birds had deliberately destroyed the nest during my absence, for the bearded portion appeared to be stretched and dishevelled as if it had been used as a ladder for descent to the ground; possibly the young birds could perform this feat unaided by their parents.

At Caermarthen, Upper Manilla, on 16th February, 1918, I found a nest of *Grallina picata* containing young birds, attached to a lower drooping bough of an apple tree (*Angophora*) overhanging a creek. After photographing the male bird on the nest, I came closer, and fixed the camera within eight feet of the nest. Box brush was used to conceal the tripod, and a few branchlets suspended from the focussing hood partly masked the camera. These birds being very shy, I retired a few paces until they became accustomed to this strange device, but they did not venture near until three Laughing Jackasses (*Dacelo gigas*) flew into the tree. These birds were partly domesticated, and would take food readily from one's hand. Probably they were attracted by the alarm call of the Grallinas, and took advantage of my presence, which they apparently appreciated. Presently the Grallinas plucked up sufficient courage to fly to the tree also, each bird keeping one Jackass at bay, thus leaving an opening for the third bird to dart down and secure a chick, which he eventually did without hesitating



The Grallina's Nest.

on the nest. This unexpected performance brought me into action at once, and my impulsive shout only scared the remaining birds from the tree. Knowing these particular Jackasses so well, I stood exposed at the camera, fully expecting them to return and secure the remaining chick, which I could distinctly see silently swaying its head about with its beak agape the while. Dr. Brooke Nicholls arrived on the scene, and I got him to arrange a few leafy twigs about my head and shoulders, and then manoeuvre round the tree to prevent the Grallinas from approaching the nest while the Jackass performed his act unmolested, but in spite of all, the Grallinas held their own, and kept the marauders on the move. Our patience was tested for another resultless hour, and eventually the sound of a cow-bell attracted the Jackasses to lunch at the homestead. During their absence I kept to my post until the Grallinas returned to the tree. The male bird flew over the nest with food, but was too shy to alight and feed the young one. The female, always on the alert to give the alarm, remained on the topmost twig preening her plumes. After lunch, my cousin joined me, and we sat together beneath the apple tree and chatted for about twenty minutes, my cousin facing the nest, which was in a direct line and scarcely fifteen feet away. I watched a clump of gums opposite for the return of the Jackasses, glancing occasionally at the nest and camera to make sure that all went well. This was the only period during the test that my eyes were not permanently kept on the nest. Now, if a Jackass,

with his heavy flight and occasional chuckle when landing, could blunder into the boughs above our heads, dart to the nest before our eyes, and fly off again without being detected, it would certainly be remarkable. A Jackass called across the creek; the Grallinas returned to safeguard their nest, while I went to the camera. Dr. Nicholls selected a shaded nook about two hundred yards away, with his binoculars trained upon the scene, prepared to signal the moment to make an exposure. Presently a plunge was made at the nest from above and behind my head, I made an exposure, but to my great surprise recorded the male Grallina, and not the Jackass, extracting the chick from the nest. Though



The male Grallina taking chick from nest.

bewildered momentarily, I noticed that the Grallina actually dipped into the nest and out again without a noticeable pause; in fact, Dr. Nicholls, looking through his glasses, declared it to be a fly past, but the photograph confirmed my observations. The Jackass was still perched on the limb above my head, glancing down into the nest. I changed the exposed plate and waited anxiously for a considerable time, but the bird eventually departed. I then decided to finish for the day by photographing the young bird in the nest. I had previously arranged to have some old cases carted in readiness for this purpose, so I placed two boxes one above the other in a suitable position, then mounted to the top, but on peeping into the nest, I was surprised to find it tenantless. I now feel positive from my observations that the young Grallina was taken by the male parent, and I am sure that the Jackass was equally mystified as to who took it.—HARRY BURRELL, Kensington.

NESTING OF PAINTED SNIPE.—On October 13th, 1917, I was in search of Snipe (*Gallinago australis*) about eight miles from my home, in a swamp formed and fed by artesian water, being the terminus of a bore drain from a bore 20 miles east. Here I accidentally discovered the nest of a Painted Snipe (*Rhynchaea australis*) with a full clutch of four slightly incubated eggs. On the following Saturday, in the same swamp I found four young Painted Snipe nearly able to fly. This was evidence enough that the first nest was not a solitary example, but subsequent searches revealed nothing more for 1917.

On 19th August, 1918, I visited the swamp again for the sole purpose of finding out more of the breeding and nesting habits of the Painted Snipe. I was fortunate enough this time to find four nests with full clutches (four eggs), one of which was just on hatching, two others about half incubated, and one fresh.

On August 24th I searched the swamp carefully and found four more nests—two full clutches (fresh) one with two eggs (cold), one nest deserted with one egg.

On September 7th I made another search, with a companion, and found one nest containing a full clutch of fresh eggs. Three other nests were found, in which the eggs had been broken. One set of three had large holes made in the side, and the contents extracted, the shell being otherwise undamaged, and one egg in another nest was in the same condition.

The swamp covers an area of about 20 acres, over most of which the water is only a few inches deep, and the grass is not more than a foot in height. The favoured spots for the nests are where the water lies in basins, and in these basins are scattered mounds of earth, the tops of which are a few inches above water level, not over one foot in diameter, and roundish in shape. On the outside edge a ring of soft grass grows, and in the centre, well concealed, the eggs are laid. Incomplete sets or fresh eggs were practically lying in a slight depression on bare mud, but as incubation increased the nests also increased, till in the one with eggs just on the point of hatching there was quite a substantial padding of soft grass collected from the surrounding grassy sides. The nests averaged $5\frac{1}{2}$ inches in diameter. In most cases I flushed both birds from the vicinity of the nest, and when they rose they did not drop again till they were 100 to 200 yards away. Altogether I counted 14 birds on one day; there may have been a few more. This is an unusually large number to find in one swamp.

In November or December one can often flush five or six birds close to the same spot, but these are invariably the old pair with the season's young.

I don't know of any part of central or north-west New South Wales where these beautiful birds are numerous, and the unfortunate thing is that when the Jack Snipe (*Gallinago australis*) comes in (about August) the Painted Snipe is nesting, both birds frequenting the same locality, and the latter falls to the gun of the sportsman, who, in nine cases out of ten, makes no distinction. In this way many breeding birds are killed each year.

On 21st September, 1918, I again visited the swamp, but could not flush a single bird; they had all gone. This may be accounted for by the fact that after the birds started nesting here there was a good fresh down the river, to the nearest point of which it would only be about three miles. Thousands of acres of good snipe lands were flooded, and the birds have probably gone to fresh pasturage.

Besides Painted Snipe, I one day counted 30 Jack Snipe and saw many other waders, Spurwing Plover, White-necked Stilt, Red-kneed Dotterel (nesting), Black-fronted Dotterel, Sharp-tailed Stint, many Little Crake, and one Greenshank.—F. C. MORSE, Coocalla, Garah, N.S.W.

[In the debate in the Legislative Assembly on the Birds and Animals Protection Bill, the member for Hawkesbury (Mr. Walker) moved that "every species of snipe" be added to the schedule of unprotected birds. He said: Snipe do not breed here, but migrate from Japan and the Islands, as do also Gillbirds. If these birds are included in the schedule, we shall be able to shoot them." Mr. Walker's statement was accurate only as regards the "Jack Snipe" (*Gallinago australis*).—ED.]



Nest of Red-kneed Dotterel.



Nest of Painted Snipe.

NUTMEG PIGEON BREEDING IN CAPTIVITY.—Mr. H. W. Stein, one of the keepers at Taronga Zoological Park, has gained the confidence of a Nutmeg Fruit Pigeon, a female under his care having become so trustful that she will readily fly to his finger and take food from his hand. On 11th December, 1917, she began to collect material for nesting, and endeavoured to build a nest in an almost impossible position until Mr. Stein induced her to occupy a site selected by him. He placed a few eucalyptus twigs in the bark of a stunted shrub growing in the aviary, and the bird immediately took charge, but deliberately threw the twigs to the ground, repeating the performance as fast as the twigs



Nutmeg Pigeon on Mr. Stein's hand.

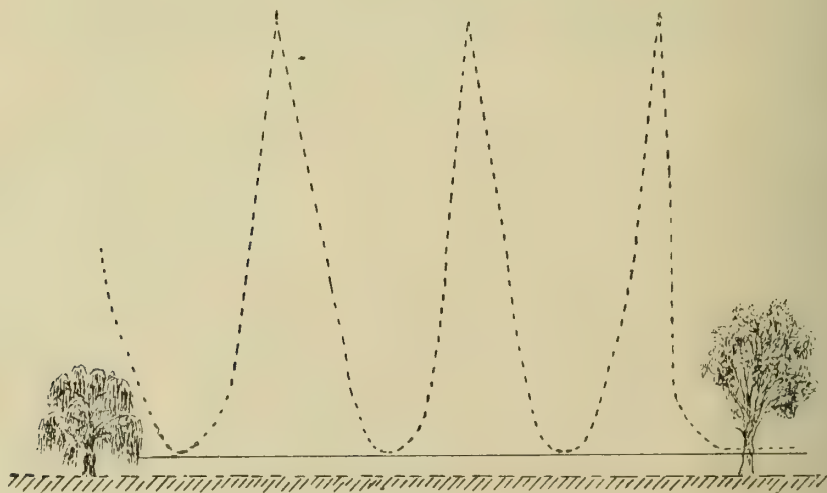
were replaced. Finally a few dead leaves secured from a Grass-tree were placed in position for her. This pliable material evidently satisfied her requirements, for as soon as the platform was erected, she took possession of the structure, and, assisted Mr. Stein to build the nest, taking the grass a blade at the time from his hand and arranging it to her liking. On 13th December she laid one egg, and the process of incubating began at once. The young bird was hatched out on 5th January, 1918, and left the nest (fully fledged) on January 23rd. During this period of 42 days, the mother was hand fed, and was never once observed to leave the nest. The male bird, though always on the alert, was never seen to take part in the proceedings, nor did he at any time appear to object to Mr. Stein's presence.—HARRY BURRELL, La Mascotte, Doncaster Avenue, Kensington.

THE FLIGHT OF A FALCON.

By THOMAS P. AUSTIN.

In writing this article I might state that most of my observations have been in connection with Black-cheeked Falcons (*Falco melanogenys*) and to this species I will mostly refer. Bold, fearless birds of magnificent flight, with wonderful powers of endurance on the wing, descending with dreadful rapidity upon their prey. Their true home is the precipitous, rocky cliffs of the coast and adjacent islands, also similar situations inland, but they are also sparingly dispersed throughout the woodlands of the whole continent. It is a glorious sight watching them sailing at a tremendous rate along the cliffs, where they appear to be in their element. They usually dip downwards some little distance before settling, then gracefully glide upwards just before they alight. To what height Falcons can fly we do not know, for no systematic attempt has been made to collect data. One observer, taking a look at the sun through a telescope, saw birds pass at what must have been a height of several miles, and these birds are said to have been kites in quest of prey. It is safe to assume that the *Falconidae* fly higher than any other group; their mode of life demands it. There is something noble in the appearance of a Falcon, which is missing in most of the larger *Accipitres*, in spite of the fact that the eagle is chosen as a national emblem in both the old world and the new. It is probable the wonderful power of vision possessed by the birds of this group is the finest in the world. The first thing which strikes one upon picking up a shot Black-cheeked Falcon is the great weight for the size of the bird; yet they are quite capable of carrying off birds slightly exceeding their own weight. Although the Goshawks are dashing birds after their prey (usually only the weaker species), they differ greatly from the Falcons in having slinking habits, waiting hidden in dense retreats to suddenly pounce upon their quarry, whereas the Falcons expose themselves in many ways. The Goshawk seldom openly shows itself if it can help it. Nor does the Goshawk strike a terrific blow, but merely seizes with its claws, and death would result from a nip with the bill. With the falcon this is unnecessary, the victim being usually killed by the terrible shock from the striking power of the claws. It would be somewhat difficult to compare the relative power of the Black-cheeked Falcon with that of the Wedge-tailed Eagle, but I feel convinced that a Falcon in relation to its size is a much more powerful bird, and is admirably adapted to its mode of life. There can be no doubt that a Black-cheeked Falcon is quite capable of killing a Wedge-tailed Eagle by a blow on the head, but it would be extremely unlikely to attack such a formidable opponent, for seldom, if ever, do birds of prey attack a dangerous antagonist; if they did, such a life and death combat in the air would be worth a long journey to witness. I also think it is highly improbable that a large Falcon will attack another Falcon of a smaller species. There is a saying that "hawks do not peck out hawks' eyes"; but the Saker Falcon will attack its kind. Trained in Palestine, chiefly for the pursuit of Gazelles, it was also flown at Kites, and the following description by an eye-witness of a contest of the latter description is illuminating:—"The Saker, after going a considerable distance from its quarry (a Kite), and thereby acquiring what he wanted—superior height—resumed the chase, returning downwards like a thunderbolt on the Kite. Blow after blow was struck, and the helpless Kite, with his merciless enemy, descended, clutched fast together, their wings expanded, in wheeling circles to the earth, where the Kite, already half dead, was soon dispatched." Falconry is now out of fashion; it is no longer a popular pastime to train birds to kill other birds. I have read statements of Falcons carrying away birds more than twice their own weight. Gould refers to a statement of Gilbert: "that he has seen a Black-cheeked Falcon carry off a Hard-head Duck (*Aythya australis*), a species at least as heavy again as itself." Now, if that Falcon were a female, I very much doubt if the duck even exceeded its weight. How many people are there who have ever taken the trouble to weigh a Black-cheeked Falcon? I have weighed several females (strange to say I never shot a male), and found the average weight to be 2 lbs. 3 ozs. I have often seen female Black-cheeked Falcons strike pigeons to the ground, but I have never been an eye-witness to one being taken on the wing and carried away without touching the ground, and when carrying the pigeon off after gathering it from the ground, the Falcons often appear to have some difficulty in doing so. My pigeons are all homers, so are large birds, but I can quite believe a Falcon is capable of seizing one on the wing and carrying it away, and that it would have no difficulty whatever in doing so with the smaller common sorts of pigeons. The sound of a Falcon striking a pigeon is somewhat startling, and it always reminds me of a dog jumping through

a hoop over which paper has been pasted. I have spent so many years in the country, also near the sea coast, and in what I might call close touch with these birds, owing to having kept pigeons, which attract the Falcons, I have had exceptional opportunities of observing them in their natural habitat, and feel that my opinion will carry some weight with those competent to judge. I should like to state that I express such opinion, not out of wanton love of contradiction, but to tell the truth, and thereby remove flagrantly erroneous conceptions from the minds of those interested in such a subject. Some little time ago I read an article on this same subject,* in which the writer stated that a Black-cheeked Falcon had no chance with a pigeon. I cannot imagine on what basis the author made such a statement. My considerable experience of these birds has taught me the contrary, and may prove interesting. On numerous occasions I have witnessed Falcons after my Homing Pigeons. On March 18th, 1915, I had a perfect view of such a contest, under circumstances which enabled me to take measurements in all respects, excepting the height the Falcon attained after each charge, and I could only make a guess at this in comparison with the height of a box tree, which was eighty feet high, and in a direct line with the contest. I saw some of my Pigeons coming home, flying very low at a great speed. Knowing this to be the usually sure sign of the appearance of a Falcon, I stood and watched. Suddenly I saw a Black-cheeked Falcon make a charge at a Pigeon, just as it came beneath the above-mentioned tree. It missed its prey, and with an almost instantaneous, graceful curve, swooped up vertically at a tremendous rate, as if shot out of a gun, to a height which I judged to be about 250 feet; then turning suddenly with half-closed wings, the neck was drawn in, the feathers compressed, and with wings almost closed, it descended with a lightning-like swoop, only to miss again. This it did three times while the Pigeon was travelling 125 yards, the measured distance from the box tree to a willow tree, where the Pigeon escaped. Therefore, if my judgment of the height the Falcon attained after each charge was about correct, the Falcon travelled 525 yards while the Pigeon was going 125 yards, and



assuming that the Pigeon took five seconds to cover the distance, it would be travelling at the rate of 51 miles per hour, so the Falcon must have been doing about 214 miles per hour. In assuming that the Pigeon was travelling at the rate of 51 miles per hour, I would not be at all overestimating its rate of speed. These birds, in trials over long distances, in some cases over hundreds of miles, have been

* *Australasian*, 25th May, 1918.

known to travel at an average rate of 45 miles per hour, and in judging that velocity the time is taken from the moment the bird is liberated until actually caught in its loft for identification. Then, it must be remembered, in these trials there is a lot of lost time, for instance, when the bird is liberated, it flies round for some little time taking its bearings before striking out for home ; then, after arriving, there is often some delay before the Pigeon enters its loft. The accompanying sketch of the contest might be of interest. The firm line represents the flight of the Pigeon, and the dotted line the flight of the Falcon. The skin of this Falcon can be seen at the Melbourne Museum in the collection presented by Mr. H. L. White, of Belltrees, Scone, New South Wales. Very many other similar instances have come under my notice, but I feel sure that the one cited will serve to explode the ridiculous theory mentioned above. The same author again referring to the above subject, states : " I have sometimes seen Black-cheeked Falcons hunting in pairs ; but the only pigeons caught were young or sick birds. The only time I ever saw a strong bird caught was when the Falcon came on it unexpectedly." This opens up another point. Some writers state that they are of the opinion that when both Falcon and Pigeon are on the same horizontal plane, the Pigeon will beat the Falcon. I have frequently been an eye-witness to such contests, and the Falcon has won every time. Then the question would naturally arise, " For how long can the Falcon keep up this terrific speed ? " That is a query which I am afraid must always remain unanswered. Then, again, other writers state that the Falcon is credited with flying when it is really falling, but surely we must give the Falcon credit for being able to fly quicker than it would fall. If the Falcon is descending at a greater rate of speed than it would fall, it must be flying. Young Golden Eagles in England were known to train themselves for flight by carrying up into the air rabbits or hares, dropping them, and recovering them long before they can reach the ground. Finally, I venture to say all my experiences tend to confirm me in the opinion that a Black-cheeked Falcon in pursuit of its prey, no matter at what angle, is the fastest living creature on wings in Australia.

THE BIRDS AND ANIMALS PROTECTION ACT, 1918.

THIS Act has received the Royal Assent, but will not be brought into operation until a date to be fixed by proclamation of the Governor. As much depends upon the Regulations which the Act empowers the Governor to make, it may be some time before the proclamation is published, and in the meantime the Birds Protection Act, 1901, and the Native Animals Protection Act, 1903, remain in force. With all their shortcomings, these Acts are useful, and active administration will do much to prepare the ground for the new measure.

The principal features of the new Act are found in the provisions protecting all birds and animals, with the exception of a few scheduled species, and establishing "districts" or sanctuaries in which no birds or animals of any species may be killed or taken, except under license. The first district is defined, and includes practically the whole county of Cumberland. Other lands of the State may be declared by proclamation to be districts, and the maximum penalty for violation of any such sanctuary is a salutary one, viz., £20.

Provision is also made for the issue of licenses to take or kill game birds or animals for sale, and limiting the number of any specified kind which may be taken in any given time.

The only serious omissions are the absence of any provision for a gun tax and the appointment of paid rangers. With regard to the latter, the police are constituted rangers, *ex officio*, and honorary rangers may also be appointed. It is doubtful whether the latter provision will be sufficient to strengthen the already overworked police force in carrying out the effective administration of the Act.

The following are the schedules of unprotected birds and animals, but the Governor may by proclamation add other species to or remove any species from the schedules, either absolutely or for any specified district :—

FIRST SCHEDULE.		SECOND SCHEDULE.	
Common Name.	Scientific Name.	Common Name.	Scientific Name.
Sparrow.....	<i>Passer domesticus</i> .	Rabbit.....	<i>Lepus cuniculus</i> .
Silver Eye.....	<i>Zosterops corulescens</i> .	Hare.....	<i>Lepus europæus</i> .
Black Cormorant or Shag.....	<i>Phalacrocorax carbo</i> .	Dingo.....	<i>Canis dingo</i> .
White-breasted Cormorant.....	<i>Phalacrocorax gouldi</i> .	Fox.....	<i>Vulpes alopec</i> .
Pied Cormorant.....	<i>Phalacrocorax hypoleucus</i> .	Fruit Bat or Flying Fox.....	<i>Pteropus poliocephalus</i> .
Little Black Cormorant.....	<i>Phalacrocorax sulcirostris</i> .	Tiger Cat.....	<i>Dasyurus maculatus</i> .
Little Cormorant.....	<i>Phalacrocorax melanoleucus</i> .	Native Cat.....	<i>Dasyurus viverrinus</i> .
Crow.....	<i>Corvus coronoides</i> .	Common Kangaroo Rat.....	<i>Potorus tridactylus</i> .
Raven.....	<i>Corone australis</i> .	Brush-tailed Kangaroo Rat.....	<i>Bettongia penicillata</i> .
Friar-bird or Leatherhead.....	<i>Tropidorkynchus corniculatus</i>	Gaimard's Kangaroo Rat.....	<i>Bettongia gaimardi</i> .
Yellow-throated Friar-bird.....	<i>Philemon citreigularis</i> .	Rufous Kangaroo Rat.....	<i>Aepyrynus rufescens</i> .
Garrulous Honey Eater or		Hare Wallaby.....	<i>Lagorhastes leporoides</i>
Miner or Soldier Bird.....	<i>Myzanthia garrula</i> .	Nail-tailed Wallaby.....	<i>Onychogale frenata</i> .
Sulphur-crested or White		White-throated Wallaby.....	<i>Macropus parma</i> .
Cockatoo.....	<i>Cacatua galerita</i> .	Paddymelon.....	<i>Macropus thetidis</i> .
Rose-crested Cockatoo or Galah	<i>Cacatua roseicapilla</i>	Red-legged Wallaby.....	<i>Macropus wilcoxi</i> .
Lory.....	<i>Platycercus elegans</i> .	Black-striped Wallaby.....	<i>Macropus dorsalis</i> .
Rose Hill or Rosella Parrot.....	<i>Platycercus eximius</i> .	Wombat.....	<i>Phascalomys mitchelli</i> .
Blue-bellied Lorikeet or Blue		Long-nosed Bandicoot.....	<i>Perameles nasuta</i> .
Mountain Parrot.....	<i>Trichoglossus novæ-hollandiæ</i>	Common Bandicoot.....	<i>Perameles obesula</i> .
Red-rumped Grass Parakeet ..	<i>Psepholus hamatolotus</i> .	Rabbit Bandicoot.....	<i>Thylacomys lagotis</i> .
Wedge-tailed Eagle or Eagle			
Hawk.....	<i>Uroæus audax</i> .		
Every species of Snipe.			
Gill-bird.			
Starling.			
White-throated Falcon.			

The last four species named in the first schedule were added as amendments to the Bill in its form as introduced, hence the absence of scientific names, and the added disadvantage of uncertainty as to what is really meant by "Every species of Snipe" and the "White-throated Falcon"—a vernacular name not found in any authoritative work on the birds of Australia.

THE CROW FAMILY.

By WALTER W. FROGGATT, F.L.S. (Government Entomologist).

OF the fowls of the air and the birds of the earth the crows are credited with supernatural knowledge and cunning before all others. In both ancient and modern literature their habits are recorded, and in folklore, song and story they are renowned in many lands. Not, however, as birds to be loved or venerated, but rather to be feared and propitiated.

Thus a writer giving an account of the survival of some of the old pagan customs in the north of Scotland says: "At the annual rural sacrifice at Bel Tein, the villagers broke their votive cakes into nine pieces; and, after throwing some of them over their shoulders to the different evil spirits, they devoted the last three thus: 'I give to thee, O fox, spare thou my lambs; this I give to thee, O hooded crow; this to thee, O eagle.'"

In ancient Egypt the crow was honoured as a bird of more than ordinary understanding. Anacreon says: "Near Lake Myris there was a monument erected to a crow by King Marthes, that was thus honoured for its intelligence. It was trained to carry his epistles with great expedition, and when he gave it orders, it immediately understood them, which way he desired its flight, through what country it should pass, and where it should stop."

Under the more ancient name of the raven, it figures in many places in the Bible. Noah sent one out of the ark to seek for dry land; Elijah was fed by ravens; Solomon says that ravens were carrion feeders, and with the eagles devoured the bodies of the evil doers who were denied burial and were cast out in the valley outside the city walls. The Greeks and Romans looked upon crows as birds of ill omen; they were unlucky. Pliny says: "These birds all of them keep much prattling, and are full of chat, which most men take for an unlucky figure and presage of ill fortune, though some there be that think otherwise, and highly esteem them." From this statement it is evident that then, as now, there were divided opinions on the crow question, and that this old world bird had some admirers among the Roman citizens, even if it sometimes looked for sick lambs on the hillsides beyond the gates of Rome.

We have many instances in modern literature of pet crows or ravens. Dickens has immortalised Gyp, the Raven; Poe, the mournful raven that perched upon the bust of Pallas; Charles Waterton, in his Natural History Essays, has given an entertaining account of his pet raven, Marco.

The writer, before taking up the question of the Raven or Crow in Australia, proposes to give a brief account of the crow family as a whole. This includes the raven, carrion crow, hooded crow, rook, and jackdaw, a number of closely-allied birds, both in structure and habits, and which have been placed by most naturalists in the Family *Corvidæ*. Several of these birds have a wide range over the face of the earth, and can adapt themselves to all kinds of climate, from the borderlands of the Arctic regions to the arid plains of the desert. They may be gregarious where food is abundant, or solitary where rations are scarce; they may live far from the haunts of man, or become semi-domesticated. They may be hunters as savage as the hawks, feeders upon offal and carrion, or even fighters for scraps with the poultry, or disputing the ownership of the bones in the eastern cities with the street dogs.

All the true crows and ravens were originally placed in the Genus *Corvus*, which is thus defined: Birds with a stout compressed beak, straight at the base, arched at the point, and straight at the edges. The wings and tail long and graduated; the feet powerful, with the metatarsus exceeding in length the middle toe.

The sexes are similar in colour, usually black, but often more or less glossed with green or purple tints, the exceptions being the hooded crows and jackdaws.

Six species are known in Great Britain and Europe, two of which have an extended range.

THE COMMON OR CARRION CROW (*Corvus corone*).

This is of a jet black colour, but smaller than the raven; and is found in similar localities. As its name implies, it feeds upon all kinds of carrion, though, at the same time, it often kills small ground mammals. It is, however, specially disliked by the farmer and gamekeeper because of its partiality to birds' eggs; and on account of the damage done to game preserves, the gamekeepers shoot them whenever they can catch them. Buckland specially mentions this crow as one of the birds nailed up against the wall, as a warning against other evildoers, in the Gamekeepers' Museum.

Bingley, writing of them in England in 1813, says: "They feed upon putrid flesh of all sorts, as well as worms, insects, and various kinds of grain. Like the ravens, they will sometimes peck out the eyes of young lambs just dropped. They also do much mischief in rabbit warrens by killing and devouring young rabbits; while chickens and young ducks do not always escape their attacks." In the reign of Henry VIII., crows increased in such numbers in England, and became such a pest to the farmers, that an Act of Parliament was passed ordering their destruction. "Every hamlet was ordered to destroy a certain number of crows' nests for ten successive years; and the inhabitants were called upon to assemble on certain dates to consider the best methods of destroying them." In the early part of the last century the inhabitants of New Jersey and Pennsylvania gave a reward of threepence a head for crows; but the Act was soon repealed, as it threatened to deplete the treasury. In the United States of America this crow is a grain eater and damages crops.

THE ROOK (*Corvus frugilegus*).

This bird is often also called the crow to distinguish it from the carrion crow. It is glossy black, with the sides of the head and neck glossy blue. It is gregarious in habit, and at nesting time forms communal nesting places, known as "rookeries." Here sportsmen often assemble at the end of the season to shoot the young rooks just as they are about to fly; and in England rook pie was considered a great delicacy.

This has been discouraged in modern times, as the farmers look upon the rooks as useful birds on account of their insectivorous habits, though they also feed to a certain extent upon seeds.

They sometimes congregate in enormous flocks; and there is a record that after a great storm at Westmeath, Ireland, 30,000 dead rooks were counted on the shores of a small lake. At nesting time, rooks are great thieves, stealing the material from each other's nests—hence the cant word, "rooking."

THE HOODED CROW (*Corvus cornix*).

This bird is smaller than the carrion crow. The colouration of the plumage is very distinct, only the head, throat, wings and tail being black; the body feathers are grey, and in contrast with the black head, give it the popular name of hooded crow. This is the species that is the deadly enemy of the shepherds of the north of England and Scotland; and it is particularly destructive in winter, when ewes and lambs are lost and helpless in the snow, and other food is hard to find.

This is the common crow of Northern Europe and through the East, ranging across India. In the open spaces about Constantinople they hunt for food ; in the garden of the British Club at Nicosia, the capital of Cyprus, they fought and built their nests ; and they are common in all the towns in Asia Minor. In India they act as street scavengers, fighting over the scraps and bones, often looking very dragged and unkempt. No one, of course, would ever think of killing one in India ; but whenever they find their way into fruit orchards they are a serious pest to the fruit growers, and boys are regularly engaged to drive them away. They are not to be confounded with the smaller Glossy Crows (*Corvus splendens*), also common in India and Ceylon ; these are the crows that the management of the Point de Galle Hotel warn their lodgers to beware of ; the notice reads : " Do not leave any small valuables about on the dressing tables, for the crows may carry them off." When the Dutch were masters in Ceylon, these small crows were protected by special laws, because they were supposed to be instrumental in spreading the seeds of the cinnamon plants.

THE RAVEN OR "CORBIE CROW" (*Corvus corax*).

This is the typical form of the crow family, common in the northern regions of both hemispheres, and it is looked upon by naturalists as the original form of which the oriental and Australian species are only varieties, and with differences caused by change of food and climatic conditions.

The raven, in the old world, feeds chiefly upon small animals, such as young rabbits, rats and mice, and it often snaps up young ducks or chickens, steals eggs from the poultry yard and the game preserves, and in winter kills young lambs in the highlands, like its cousin the Hooded Crow. Under ordinary conditions it is a scavenger, cleaning up animal refuse, dead animals and other carrion.

A writer, in the early part of the last century, divided the ravens into two groups—the country ravens, with clean plumage, and the London ravens, with dragged tails and stained wings from grubbing in the streets.

The raven is the largest of the crow family. It is of a general glossy black colour, with a rich sheen upon the neck and shoulders. In some places it is solitary ; in others gregarious ; and at certain seasons they gather together in immense flocks.

THE AUSTRALIAN RAVEN OR CROW (*Corone australis*).

Though our common crow is really the Australian variety of the European raven, it is to our bushmen the crow ; and it will probably be known as such to the end of our days, in spite of the dictum of the Ornithologists' Unions.

As for the differences of opinion among our bird men as to what are the distinctive characters between the white-eyed crow and the hazel-eyed crow, which they distinguish respectively as the crow and the raven, I take the bushman's part and call them both crows. It is a well-known fact that in Britain the raven and the hooded crow breed together, and so do our two species ; hence the border line between the two is certainly not easily recognised by the bush naturalist.¹

¹.—The Hazel-eyed Crow (*Corvus coronoides*) is distinguished from the Raven (*Corone australis*) not only by the colour of the iris, but by the bases of the feathers on the upper parts, which are snow-white in the Crow and dusky-grey in the Raven. The latter has a bunch of lanceolate feathers, tinged with green, on the throat. There are two varieties of the Crow, a small species inhabiting western New South Wales, Victoria, and South Australia, being distinguished as *Corvus bennetti*. This bird is only 16 inches in length, as compared with the 20-22 inches of his coastal congener. The bushman might easily confuse the two larger birds, as a close examination and handling is necessary to distinguish them by their generic characters, but the little Bennett's Crow would strike him on sight as something different. The Raven is the common bird in the west and central districts, the Crow being more a coastal bird. I have not hitherto heard of the two breeding together.—Ed.

Mr. Ernest Officer, "Zara," Wanganella, says: "I am glad to give you my views as regards the value of my friend the crow. First, as a scavenger. During the summer it is impossible to burn carcasses here, so I instruct the sheep men to rip up every carcass they find if it is too far gone to skin. When it is thus treated, the crow soon cleans it all up and thus prevents flies breeding. Of course, they get at a lot that are not treated thus, but it helps them to open up every carcass one finds. Second, as an insect destroyer. We suffer severely at times from grubs or caterpillars, which swarm over vast areas and devour all the herbage, leaving the country absolutely bare behind them. The Ibis and the Crow are the only birds I know that have any real effect upon them, the former in the grub state and the latter after pupation.

"I have seen the crows at work the whole of the summer digging at the roots of the smaller bushes where these grubs generally go into the earth to pupate. Round these bushes one can count hundreds of the empty pupa cases, the crows having dug them up and devoured the contents. On one occasion I rode along a line of fence for at least a mile and counted the empty pupa cases scattered round the base of every post, and the number was never under twenty. Of course, they eat grasshoppers, and, more important, still, their eggs in large quantities, which they dig up with their powerful beak. I know perfectly well his bad traits, and have at times prayed in my foolish way for the death of the whole tribe, but, fortunately, the gods were not out to destroy me, and my prayers were not granted. Their worst offence is picking out the eyes of ewes which are cast; at times this is serious, but if the paddocks are properly looked after, we do not lose many. As to the killing of young lambs, I am sure in most cases the crow has only hastened nature. You know what hasty conclusions people jump to: A crow is eating a lamb, that crow killed my lamb, damn that crow, and let us offer a bonus for his head."

The Australian crow is about the same size as the European raven, with similar shining, glossy, black plumage, black legs and beak, with the eyes either white or hazel.

It has a wide range all over Australia, along the coastal forest lands, in the rugged mountain ranges, or on the great shimmering grassy plains, or among the inland scrub and saltbush; camp wherever you may, if there is water and a hope of something to eat, you will hear the many variations in the melody of the crows' call-notes. In the early morning, a long-drawn-out cry comes up from the river gums ere he sets out for his breakfast; the shorter, conversational notes when congregated, feeding upon the plains; the more mournful, almost weird, long-drawn-out call from the scrub of the solitary crow in the noonday heat, or the general, happy chatter and gurgle when they gather together in large mobs in the early spring—all these can be translated to you by the observant bushman.

When nesting, the crows construct a substantial nest of small sticks and twigs, with a central cup lined with hair, wool, feathers or other soft materials gathered up in the vicinity of the home. Four² dark green blotched eggs are laid, and the resultant young crows, before they get their feathers, cannot be considered very handsome babies. The parent birds usually take some trouble in the selection of a suitable tree and place the nest among the slender branches out of harm's way.

The crow is not a popular pet like our magpie; but when kept in captivity becomes very tame and friendly. In the Botanic Gardens the two specimens shut up in the aviary seem to have very restless dispositions, and only talk in their short, croaking call notes.

² Where food is plentiful, five is an ordinary clutch, and six by no means rare.—ED.

Some years ago (1896) Dr. Cobb wrote a paper, published in the *Agricultural Gazette*, New South Wales, entitled "The Common Crow," the information it contained being based upon the observations he made during a short residence in the Wagga district.

He, however, generalised upon the American species of crows, quoting copiously from United States Bulletins and Reports upon their life history and food habits, and with very little actual knowledge of the different conditions of crow life in the pastoral and farming districts of Australia. His arguments are not convincing; and even while advocating the economic value of the crows, and the reason for their protection, he concluded his article with a number of suggestions for destroying or driving them away.

Early in the following year, the late Mr. William Farrar, our well-known wheat investigator, at that time farming in the Queanbeyan district, wrote a criticism of Dr. Cobb's paper, which appeared in the same journal, under the title "The Too Common Crow." He treated them from the farmer's point of view; they were to him an unmitigated pest; he could say nothing in favour of the Common Crow.

As a body the pastoralists have waged a war of attempted extinction against the crows on the sheep lands of Australia; and the fact cannot be disputed that, taken as a class, the crows are responsible for the destruction of many sick sheep and weak lambs, particularly in a bad season. Sheep and lambs, even if only slightly wounded by the stout beak of the crow, seldom recover, but die apparently from blood poisoning, the filth upon the beak of the carrion-feeding bird producing organisms rendering the slightest wound septic. The fact that in many cases the ewes and lambs that die from the interested attentions of the crows would never get upon their feet again, does not alter the viewpoint of the sheepowner, and the crows are debited with many murders that they have not committed.

Many Pastures Protection Boards have a fund allotted to pay for crows' heads; and large sums are disbursed annually for crows' scalps. Many disputes arise among the members of these Boards when trying to fix a uniform rate of payment all over the country. In some districts, on the other hand, where the landowners have more regard for the good work that crows can do, they refuse to sanction a crow bonus.³

From the many letters on the crow question that appear in the pastoral and country papers, it can be seen that quite a number of the correspondents are in favour of abandoning the destruction of crows; while many other lukewarm friends admit that the crows are not all bad.

Allowing for the damage they do in attacking sick sheep and helpless lambs, the value of the crows to the men on the land, under natural conditions, is a very big set-off to be considered. The ordinary food of the crows is insects; you have only to watch a number hunting over the paddocks or grass lands to realise what a number of grass-feeding insects it must take to daily feed such a large bird as a crow. When a caterpillar or grasshopper plague appears, and crows are about, they soon gather upon the infested areas and do yeoman service in reducing these and other insect pests.

It is not only, however, as a useful insectivorous bird that the crow should be considered, but as an eater of dead animal matter; for, as a scavenger the crow stands alone. Where the stockowner skins and opens out all the animals that die on his run, and crows are plentiful, they will soon pick the skeletons clean and prevent the fly maggots, even if deposited on the carcase, from developing to adult flies. This is no small thing to be considered in their favour, and means a great saving in burning or destroying carcases, where crows are active. Under normal conditions, the many smaller eagles and hawks, with the crows, kept the bush lands of Australia clean and sweet. The small eagles and hawks have vanished in all the settled districts through the use of poisoned baits for wild dogs and dingos; but the crow still holds his own, though in reduced numbers.

³.—In this connection the several opinions of Messrs. Henry L. White and Thomas P. Austin, contained in their contributions to this journal (Part V.) are interesting. Both writers are graziers, occupying similar country, and their views are diametrically opposed.—ED.

A gentleman has been recently writing to the pastoral journals and newspapers advocating the introduction into our western lands of carnivorous scavenger birds from India and Africa, to do away with the blowfly pest. All the objections that the sheepowners can bring against the crows can be urged against the Turkey Buzzards or Vultures of America, and the Indian Adjutant or Marabou Storks.

The following notes are taken from a letter by the writer which appeared in the May number of the "Pastoral Review," 1918 :—"When the writer was in the Hawaiian Islands in 1907, a sheep maggot fly was infesting the flocks on the ranches, and the sheep men suggested to the Federal authorities that they might be allowed to introduce 'Turkey Vultures,' also known as Turkey Buzzards, into these islands from Texas. These carrion birds have an extended range from the Southern United States, through Cuba, Mexico, the West Indies and South America, where they are recognised as the most effective scavenger birds. When consulted, however, the Texan ranchmen strongly advised against their introduction, as they fouled all the watering places of the stock and were known to spread anthrax.

"Later on I had many opportunities of investigating the habits of these birds in Mexico and Cuba. At sunset I often watched hundreds of them winging their way into the town, to roost upon the dome of the Cathedral or the roofs of the public buildings, generally situated in the centre of the town. In the daytime one often saw them like our starlings, in the poultry yards in the villages, quarrelling with the poultry for the scraps. In Jamaica the blacks call them 'Jim Crows,' and when carrion is scarce they often snap up the chickens. My host at Spanish Town shot one in the act and I examined the remains, which, for smell and uncleanness, knocked out our Australian crow, who is a gentleman in comparison to a 'Jim Crow.' If we introduced such birds into our western plains, and they increased in sufficient numbers to become valuable as scavengers, where would they spend their evenings? What would the good citizens of Hay or Deniliquin say, for example, if swarms of these buzzards, as large as small turkeys, came flying in every night to roost and quarrel on the roofs of their public buildings."

As regards the Crow, the writer, in a paper in the Agricultural Gazette of New South Wales, has given some testimonials in his favour from landowners of experience. Mr. Arthur C. V. Blich, writing from Condamine Plains, Brookstead, Queensland, on the blowfly question, says: "Any sheep dying that are missed are cultivating a fine crop of flies for future trouble. Being situated on the plains the carcasses are hard to destroy, but I find by skinning any sheep (I find in time) the crows clean the flesh from them in a few hours and leave them absolutely safe, as far as blowfly maggots are concerned. These birds, I think are invaluable as insect destroyers, and in cleaning up this way are a great assistance to the stockowner."

Mr. P. Brookfield, the member for Broken Hill, speaking on the Birds Protection Bill, said: "Many people denounce the crow as one of the cruelest and most vicious of birds. It is only a matter of surrounding conditions. In the north of Queensland, where the cattle pest is prevalent, the crow, so far from being a menace, is an assistance to the cattle raiser. I have many times seen a beast covered with ticks lie down and allow the crows to alight upon him and pick the ticks off. The tick, like every other parasite, clings to the poor beast with greater tenacity than to the healthy one. When the parasites were cleared off from one side, the beast would rise up and lie on the other side, and allow the crows to clean that side."

This is a record of the crow under the new rôle of a cattle tick destroyer, which the writer has not previously seen noted.

That the crow often becomes a pest bird in a bad season, among weak ewes and lambs in particular, cannot be disputed. That he can also be considered a very valuable assistant to the farmer and stockowner cannot be questioned. As an insect-eating bird alone he has the qualifications of large size, a very healthy appetite, and the habit of gathering together in large numbers and systematically hunting over the surface of the plains all the year round.

As a scavenger the crow is our most effective ally in cleaning up all kinds of dead animal matter that would otherwise be neglected and become the breeding ground of countless hosts of blowfly maggots. If a pest at times on the coast, it is certainly looked upon in the west and north-west by many observant landowners as a bird to be encouraged.

The writer considers wholesale condemnation of crows is a grave mistake, and that their indiscriminate destruction should not be allowed, for in most places the crows do more good than harm to the man on the land, and should be protected where they are useful. This could be very easily managed under a comprehensive Birds Protection Act, drafted by the Council of the Wild Life Protection Society, and recently passed by Parliament. When brought into operation this Act will admit of crows or any other birds of mixed values being shot and driven away by proclaiming them noxious birds and black-listing them in any particular district where they are causing damage. When no damage can be placed to their discredit, they should have the same protection as other useful or harmless birds.

The photograph shows how clean they can pick the bones of a dead sheep when it has been skinned, and in the Brewarrina district the writer has seen the skins cut and turned inside out laying beside the clean picked bones, so that the crow is certainly the best scavenger bird we have in Australia.



Picked clean by a crow.

CONTENTS OF PART I.

	Page
Report of the Council for 1913.....	1
The Mallophaga as a possible clue to Bird Phylogeny, by Launcelot Harrison, B.Sc.....	7
Bird Sanctuaries, by A. F. Basset Hull.....	13
A Monograph of the genus <i>Tisiphone</i> , Hübner, by G. A. Waterhouse, B.Sc., B.E., F.E.S.....	15
A new Victorian Araneiad, by W. J. Rainbow, F.E.S.....	21
Notes on the Breeding-habits of the Purple-striped Gudgeon, <i>Kreffinius adspersus</i> , Castelnau, by Albert Gale.....	25
A new Australian Caprellid, by the Rev. Thomas R. R. Stebbing, M.A., F.R.S., F.L.S., F.Z.S....	27
Notes on some Australian Syngnathidae, by A. R. McCulloch.....	29
Bird Notes from the North-west of New South Wales, by Walter W. Froggatt, F.L.S.....	33
An Interesting Exhibit, by A. S. Le Souef, Director, Zoological Gardens.....	35

CONTENTS OF PART 2.

Report of the Council for 1914.....	37
List of Members, 1914.....	41
Bird Notes, by Walter W. Froggatt, F.L.S.....	44
Two Beetles apparently new to Australia, by W. J. Rainbow, F.E.S.....	46
The Migration of the Jolly-tail or Eel Gudgeon, <i>Galaxias attenuatus</i> , from the sea to fresh-water, by A. R. McCulloch.....	47
Further notes on the genus <i>Tisiphone</i> , Hübner, by G. A. Waterhouse, B.Sc., B.E., F.E.S.....	50

CONTENTS OF PART 3.

Report of the Council for 1915.....	53
Some new Araneidae from the County of Cumberland, by W. J. Rainbow, F.E.S.....	58
Notes on Colour-variation of Opossums of the genus <i>Trichosurus</i> , by A. S. Le Souef, Director Zoological Gardens.....	62

CONTENTS OF PART 4.

Report of the Council for 1916.....	Front Pages
The Royal Zoological Society of New South Wales. Its present position and future aims, by A. F. Basset Hull, President.....	65
The Economics of <i>Trichus niloticus</i> , by Charles Hedley.....	69
The Destruction of Bird Life in Australia, by Walter W. Froggatt, F.L.S.....	75
The Lyre Bird: Some Nesting Notes, by John Ramsay and Albert E. Keene.....	81
Kangaroos in Captivity, by H. L. White.....	83
Illustrations of Australian Coleoptera, by A. Musgrave and E. H. Zeck.....	85
The deposition of the eggs of Monotremes, by Harry Burrell.....	87
Ichthyological notes, by Allan R. McCulloch.....	89
The Great Black Palm Cockatoo, <i>Microglossus aterrimus</i> , in captivity, by Dr. E. A. D'Ombain, M.R.A.O.U.....	95

CONTENTS OF PART 5.

	Page
Taronga Zoological Park.....	99
Royal Zoological Society of New South Wales.....	100
The Distribution of <i>Anaspides</i> and <i>Ooperipatus</i> in Tasmania, by Professor T. Thomson Flynn..	102
Birds in my Garden, by Henry L. White.....	103
The Birds of the Cobbora District, by Thomas P. Austin.....	109

CONTENTS OF PART 6.

Royal Zoological Society of New South Wales:	
Report of Annual Meeting.....	139
Balance Sheet.....	142
List of Members.....	143
Notes on some of the Smaller Marsupials of the Genera <i>Phascogale</i> , <i>Sminthopsis</i> , <i>Acrobates</i> and <i>Dromicia</i> , by A. S. Le Souef, Director, Zoological Gardens, and Harry Burrell.....	147
Notes on records of Tree Kangaroos in Queensland, by T. Harvey Johnston, M.A., D.Sc., and C. D. Gillies, M.Sc., University of Queensland, Brisbane.....	153
Rescue Operations on the Murrumbidgee River, by H. K. Anderson, Inland Fisheries Officer.....	157
Notes on the Kelp Shell <i>Cantharidus irisodontes</i> , by Ernest Mawle.....	161
Notes on the Life History of an Emerald Moth, <i>Eucyclodes metaspila</i> , Walker, by E. H. Zeck.....	163
Studies in Phlebotomic Diptera, No. 1. New Species of Simuliidæ and Chironomidæ, by Frank H. Taylor, F.E.S.....	167
A Parasite, <i>Myxobolus hylae</i> , sp. nov., of the reproductive organs of the Golden Swamp Frog, <i>Hyla aurea</i> , by T. Harvey Johnston, M.A., D.Sc., and M. J. Bancroft, B.Sc.....	171
Ornithological Notes, edited by A. F. Basset Hull.....	177
The Flight of a Falcon, by Thomas P. Austin.....	185
The Birds and Animals Protection Act, 1918.....	188
The Crow Family, by Walter W. Froggatt, F.L.S.....	189

THE AUSTRALIAN ZOOLOGIST

Issued by
The Royal Zoological Society of New South Wales

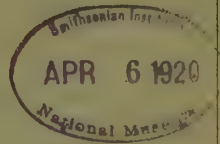
Edited by
ALLAN R. McCULLOCH
Zoologist, Australian Museum

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Royal Zoological Society of New South Wales

ESTABLISHED 1879

REGISTERED UNDER THE COMPANIES ACT, 1899 (1917)

COUNCIL 1919-1920.

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S. T. D. Symons, M.R.C.V.S.

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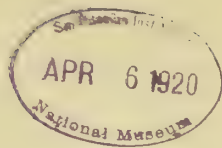
SUBSCRIPTION : Ordinary Member, £1 is. per annum.

Associate Member, 7s. 6d. " "

PRIVILEGES :

Ordinary Members—Free admission to Taronga Zoological Park; Additional Tickets admitting 20 Adults or 40 Children; Free Copy of "Australian Zoologist."

Associate Members :—Free Copy of "Australian Zoologist."



Royal Zoological Society of New South Wales.

THE second annual general meeting of the Society was held at Taronga Park on Saturday, 26th July, 1919, at 3 p.m.

Twenty-three members were present.

PRESIDENTIAL ADDRESS.

The President (Mr. A. F. Basset Hull) read the following report :—

Ladies and Gentlemen,—Since the first annual general meeting of the incorporated Society, held on 27th July, 1918, the devastating war which then overshadowed all our world has come to an end, and we are now entering upon what we all trust will be a prolonged era of peace, in which our social and scientific endeavours may have the fullest opportunities of expansion.

During the past year the Society's work has necessarily been subordinated to the urgent need of husbanding its resources in view of the heavy war-time expense of printing, paper, and postage. The restrictions in regard to despatch and distribution of extra-Australian mails have also interfered with the circulation of our Journal, which is intended not only for Australian readers, but is sent to most of the scientific institutions throughout the world in exchange for their publications. Many inquiries have been made from abroad for missing numbers lost by submarines or held back owing to war-time embargoes. Hence we have contented ourselves with the issue of one number only of the "Australian Zoologist," leaving a more frequent issue to more propitious times.

MEMBERSHIP.

At the end of June, 1918, the Society's roll of members contained the names of 140 ordinary, 7 honorary, and 7 associate members—a total of 154. At 30th June, 1919, the numbers had increased to 221 ordinary, 6 honorary, and 17 associate members—a total of 244, being an increase of 90 members.

OBITUARY.

The Society has lost by death :—

Alexander Horsburg Turnbull, elected in 1915.

Mr. Turnbull died at his birthplace, Wellington, New Zealand, on 27th June, 1918. He was an enthusiastic collector of books, his particular aim being to accumulate as complete a collection as possible of works relating to New Zealand, Australia, and the South Sea Islands. He bequeathed his library of about 80,000 volumes, valued at £50,000, to his fellow citizens.

Sir Philip Sydney Jones, for many years a member of this Society, died at his residence, Strathfield, New South Wales, on 18th September, 1918. He was born in Sydney in 1836, and graduated as Bachelor of Medicine in 1859, taking his degree at the University of London. He returned to Sydney in 1861, and commenced practice in College Street. He took great interest in the progress of education in New South Wales, and especially the education of medical students. He was a member of the Senate of the University from 1887 until the time of his death. He also took an active part in many institutions, being one of the original members of the Linnean Society of New South Wales, and a Trustee of the Australian Museum.

Arthur Muggridge, of the firm of Pitt, Son & Badgery, Limited, who was elected in 1913, and was an enthusiastic supporter of the Society, and instrumental in securing the election of a large number of new members.

Clarence Arthur Edenborough Simms, an officer of the Department of Mines, Sydney, elected in 1917.

THE COUNCIL.

Mr. A. E. Jaques and Dr. Sydney Dodd resigned from the Council at the beginning of the financial year. Mr. Aubrey Halloran, B.A., LL.B., and Mr. R. J. Tillyard, D.Sc., were elected to fill the vacancies. Seven meetings of Council were held during the year, the attendances at which were as follows:—Messrs. Hull, Waterhouse and Finckh, 7; Mr. Froggatt, 6; Messrs. Hedley and Rainbow, 5; Drs. D'Ombrain and Tillyard, 4; Messrs. Halloran, Shipway and Symons, 3; Professor Johnston, Colonel Spain, Messrs. Campbell, Shiress, and McCulloch, 2. Mr. Hedley was absent from the State for some months, Messrs. Shipway and Shiress were granted leave of absence for three and four months respectively; Dr. Todd was granted leave of absence for the year, being engaged in war work, and Professor Chapman's duties prevented his attendance at Council meetings.

FINANCES.

The balance sheet to 30th June, 1918, covering a period of eighteen months, showed an amount of £121 14s. 11d. to credit, and £50 invested in War Loan Stock, as the nucleus of a Capital Fund. The statement which the Honorary Treasurer will present to-day shows a credit balance of £67 19s. 1d., and the Capital Fund is increased to £150. The income from fines under the Birds and Native Animals Protection Acts was only £18 19s. 6d., as compared with £45 6s. 8d. for the period ended 30th June, 1918. This reduction is owing to the repeal of the Acts of 1901 and 1903, which have been superseded by the Birds and Animals Protection Act, 1918. This Act came into force on 1st January, 1919, and the payment to this Society of a moiety of the fines ceased from that date. As indicated in last year's report, the Government were asked for a subsidy in consideration of the loss of the income from fines, and also as a recognition of the Society's educational work, and I am now pleased to be able to announce that a sum of £50 has been placed on the Estimates for that purpose by the Chief Secretary, Sir George Fuller.

AUSTRALIAN ZOOLOGICAL HANDBOOKS.

On the occasion of our last annual meeting I referred to the want of inexpensive handbooks to the animals, birds, reptiles and insects of Australia, expressing the hope that some public-spirited men would combine to provide funds which, properly invested, would yield an income sufficient to secure the issue of such handbooks by this Society. Up to the end of the financial year, however, my hope had not been realised. The continuance of the war, with its consequential demands upon the public for contributions to patriotic and charitable funds, and the recurring War Loans, had first to be satisfied. Now that peace once more reigns, I venture to predict that it will not be long before my hope is realised in some measure. Our Honorary Secretary, Mr. G. A. Waterhouse, who shares my aspirations in this respect, has suggested that instead of waiting until the capital fund is large enough to meet the cost of publishing handbooks from its income, a sum of, say, £500, might be raised, out of which the cost of producing one or two handbooks could be defrayed; all returns from sales of these books to be applied in recouping the principal sum until it is large enough to meet the expense of another handbook. This, then, is our first objective—to raise £500—and a commencement has been made, our members Sir James Burns, Mr. C. H. Hoskins and Mr. Kelso King having each donated £10 towards the Publication Fund.

[Since the date of the annual meeting the following additional donations have been received:—Walter and Eliza Hall Trust, £50; Thomas Phillips Austin, Cobborah Estate, £10 10s., and Henry Luke White, Belltrees, Scone, £10 10s.]

FURTHER OBJECTIVES.

Under the terms of our association with the Taronga Park Trust we are to be afforded facilities for conducting scientific investigations at the Park. To provide the necessary buildings, cages, and receptacles for housing the animals, birds, reptiles and insects to be studied, a considerable sum of money will be required, and as the conditions attaching to scientific study and investigation do not always admit of throwing the objects of study open to public inspection generally, the Trust could not, of course, be expected to bear any large proportion of the expense.

For one reason particularly the work of investigation does not lend itself to public spectacular effect in the daytime; that is, because most of the indigenous animals are nocturnal in their habits, and they must be studied after nightfall and in a light reduced to the minimum amount required for accurate observation. The zoological collection contained at present in the Park includes very many rare and interesting Australian species which in daylight are either hidden away in their sleeping boxes, curled up into balls of fur, or, if induced to move at all, are so dull and lethargic as to attract little interest. If these animals could be seen just after sunset in compartments sufficiently large to allow their activities to have full play, a world of wonder and amusement would be opened to the spectators. Perhaps at some future date a building might be erected near the entrance to the Park for the housing and display of the Opossums, Squirrels, Native Cats, Wombats, and Native Bears, in such a manner that both scientific observers and the public could derive pleasure and profit from watching these nocturnal animals under conditions as nearly natural as possible. In the construction of such a building the funds of both this Society and the Trust might be employed to mutual advantage. The building to which I refer would be in an oval or circular shape, formed of a series of strong wire compartments, varying structurally in accordance with the nature of the animals to be placed therein. The compartments for the Opossums and Squirrels should be of comparatively light construction, lofty, and provided with trees or branches, swings, and other fittings, to allow the animals free exercise. The Wombats and Native Cats should be housed in more solid structures, with reinforced concrete foundations and floors, filled in with sufficient earth to enable them to excavate their natural burrows or nests. These compartments would enclose a circular or oval walk, surrounding a central cage, also divided into compartments, in which the very small marsupials could be accommodated. The whole building would be lighted by electricity so arranged as to supply a subdued but well-diffused light. A special entrance would be provided in such a manner as not to admit of access to the remainder of the Park.

FINAL OBJECTIVE.

Lastly, there is the objective of a Central Hall of Science, to be erected in Sydney for the headquarters of the Society—to contain a large lecture hall, committee rooms, offices, library, laboratory, and other conveniences, open to the use of not only this Society, but to kindred scientific and literary societies. Such a Hall would be a fitting monument to Peace and the Progress of Science, and a worthy crown to place upon the labours of this Society. To achieve this end I confidently appeal to the public-spirited men in New South Wales, and estimate the sum required at £20,000.

The Honorary Treasurer presented the following Balance Sheet and Statement of Accounts :—

Royal Zoological Society of New South Wales.

CAPITAL ACCOUNT.

LIABILITIES.			ASSETS.		
	£	s. d.		£	s. d.
Appropriations to Capital Account, viz :—			War Loan Inscribed Stock (5%).....	150	0 0
To 30th June, 1918.....	50	0 0			
To 30th June, 1919.....	100	0 0			
	<u>£150</u>	<u>0 0</u>		<u>£150</u>	<u>0 0</u>

STATEMENT OF RECEIPTS AND EXPENDITURE FOR THE YEAR ENDED 30TH JUNE, 1919.

RECEIPTS.			EXPENDITURE.		
	£	s. d.		£	s. d.
Balance from 1918—In Savings Bank...	119	10 6	Printing "Australian Zoologist," Part VI.	78	0 0
In Hand, Hon. Treas.	2	4 5	Blocks for do.	15	13 8
Subscriptions.....	128	9 6	Printing.....	14	3 0
Fines.....	18	10 6	Box, G.P.O.....	1	0 0
Sale of "Australian Zoologist".....	5	14 0	Petty Cash—Postages.....	11	4 11
Authors' Reprints.....	4	10 0	Stationery.....	1	4 10
Donation.....	1	0 0	Exchanges.....	0	8 0
Exchange.....	0	4 0	Sundries.....	0	2 9
Interest, War Loan.....	6	7 6	Petty Cash in Hand.....	4	3 11
Savings Bank.....	2	16 10	Appropriation to Capital Account.....	100	0 0
	<u>£289</u>	<u>16 3</u>	Balance in Savings Bank, 30th June, 1919	63	15 2
				<u>£289</u>	<u>16 3</u>

G. A. WATERHOUSE, Hon. Treasurer.
4th July, 1919.

We have examined the Books and Vouchers of the Society for the twelve months ended 30th June, 1919, and certify the above Statement of Receipts and Disbursements to be in accordance therewith.

L. S. DRUMMOND & CO.,
Incorporated Accountants.

SYDNEY, 7th July, 1919.

The Report and Balance Sheet were adopted.

Mr. C. Hedley gave a lecturette, "About Hands."

Mr. G. A. Waterhouse exhibited two families of a Butterfly, *Catopsilia pomona*, Fabr. The first family consisted of 18 individuals reared from eggs laid by a female *C. pomona*; the second family consisted of 55 individuals reared from eggs laid by a female *C. crocale*, Cram. This family contained females of both *C. pomona* and *C. crocale*.

Mr. Neville Cayley exhibited a number of water-colour drawings of Australian birds, prepared for illustrating a work that he and Mr. A. S. Le Souef propose publishing.

The following members were elected to fill vacancies in the Council, in accordance with the provisions of Article 23 :—Messrs. H. E. Finckh, A. Halloran, C. Hedley, A. F. Basset Hull, W. J. Rainbow, and Dr. R. J. Tillyard.

At a meeting of the Council held at the conclusion of the Annual General Meeting, the following officers were elected :—President, W. W. Froggatt, F.L.S., F.E.S.; Vice-Presidents, H. E. Finckh, S. T. D. Symons, M.R.C.V.S., R. J. Tillyard, M.A., D.Sc., and G. A. Waterhouse, B.Sc., B.E.; Honorary Secretary, A. F. Basset Hull, R.A.O.U.; Honorary Treasurer, G. A. Waterhouse; Honorary Librarian, H. E. Finckh; Honorary Editor, A. R. McCulloch.

Royal Zoological Society of New South Wales.

The following new members have been elected since the publication of the list on 30th September 1918 (p. 143) :—

ORDINARY MEMBERS.

- ALDERDICE, CHARLES JOHN, 20 Beaconsfield Road, Mosman.
- ANDERSON, J. A., Newstead South, Elsmore, N.S.W.
- ASCHER, CLIVE LOVELL, "Tarawa," Harbour Street, Mosman.
- AUSTIN, HARRY L., Eli Elwah, Hay, N.S.W.
- BARKER, JOHN REGINALD, c/o Birt & Co. Ltd., 4 Bridge Street, Sydney.
- BAUM, HARRY W., 92B Pitt Street, Sydney.
- BINNIE, GEORGE, 4D, Quirindi, N.S.W.
- BLACK, PERCY GEORGE T., c/o Burns, Philp & Co. Ltd., Bridge Street, Sydney.
- BOOTH, FRANK HOLROYD, Victoria Arcade, Sydney.
- BOYLAN, WILLIAM JAMES, 528 Kent Street, Sydney.
- BROADBENT, WILLIAM WILKINS, "Cotswold," Ruby Street, Mosman.
- BROWN, FREDERICK GEORGE, "Glengyle," Beaconsfield Road, Mosman.
- BRYCE, ERNEST, "Daisy Bank," Point Road, Woolwich.
- CAPEL, RICHARD, "Gournara," Wialda, N.S.W.
- CLARK, ROLAND C., "Girraween," Mary Street, Clifton Gardens.
- CLELAND, DR. J. BURTON, Department of Public Health, Sydney.
- COBHAM, G. M., "Mascotte," Middle Head Road, Mosman.
- COLQUHOUN, PERCY BRERETON, M.L.A., Parliament House, Sydney.
- COOPER, FRANK A., 40 Bellevue Street, North Sydney.
- CRAWBE, ROBERT MAYNARD, Thompson Street, Mosman.
- CRAGO, DR. WILLIAM HENRY, 185 Macquarie Street, Sydney.
- CROSS, G. T., 2 Bridge Street, Sydney.
- DANGAR, L. A., Yallaroi, Wialda, N.S.W.
- DICKESON LEWIS HASELL, "Wanstead," Bradley's Head Road, Mosman.
- DICKSON, DAVID P., 64 Pitt Street, Sydney.
- ENNOR, ALFRED EDGAR, "Ravenswood," Buena-vista Avenue, Mosman.
- FISH, A. L., 103 Elizabeth Street, Sydney.
- FRAZER, D., Woollen Mills, Parramatta.
- GIBB, CHARLES A., 6 Hunter Street, Sydney.
- GILL, G. T., 15 Raglan Street, Mosman.
- GOLDFINCH, GILBERT M., Salisbury Road, Rose Bay.
- GORDON, JOHN SLOAN, Glen Alpine, Werris Creek.
- GOULD, HENRY, Simpson Street, Mosman.
- GRACE, A. F., Colonial Sugar Refining Co., O'Connell Street, Sydney.
- GRANT, ADAM F., "Les Charmettes," Want Street, Mosman.
- HARDY, G. H., 182 Victoria Street, Darlinghurst.
- HAUGHTON, JOSEPH GIHON, Tyree Station, Dandaloo.
- HAYMET, EUGENE MANORANGI, 25 Wellesley Street, Mosman.
- HEARNE, WILLIAM GOODALL, "St. Fillans," Buenavista Avenue, Mosman.
- HIGGS, REGINALD FRANCIS, 22 Carrington Street, Sydney.
- HOLLAND, ALBERT ANDREW, 15 Ruby Street, Mosman.
- HOLLOWAY, HENRY GEORGE, 10 Middle Head Road, Mosman.
- HOLMES, DR. H. GLENNIE, 120 Military Road, Mosman.
- HOOD, DR. ALEXANDER JARVIE, "St. Mungo," 14 Wylde Street, Pott's Point.
- HORDERN, SIR SAMUEL, Kt., Babworth House, Darling Point, Edgecliff.

JONES, ROBERT EDWIN, "Wanstead," Bradley's Head Road, Mosman.

KING, LAURANCE LEONARD, Union and Ruby Streets, Mosman.

KING, WALTER, Thompson Street, Mosman.

MACARTHUR, E. J. BAYLY, Union Club, Sydney.

MAWHINEY, HUGH ARTHUR, The Prairie, Moree, N.S.W.

MELLOR, WALTER L. "Stamford," Forest Road, Penshurst.

MILES, WILLIAM JOHN, Challis House, Martin Place, Sydney.

MOORE, HON. SAMUEL WILKINSON, "Karoola," Wahroonga.

MORRIS, DR. WILLIAM REGINALD, "Craignish," 185 Macquarie Street, Sydney.

MURRAY, PATRICK DESMOND FITZGERALD, "Brackland," Cheltenham Rd., Beecroft.

NEILD, EDWIN, 15 Raglan Street, Mosman.

NEWMAN, ROBERT H., Hotel Buenavista, Mosman.

ORR, JAMES BLEAKLEY, The Boulevarde, Strathfield.

PACKER, LEWIS, "Melita," Milton Avenue, Mosman.

PALMER, JOSEPH SMITH, 96 Pitt Street, Sydney.

PARKES, CHARLES MOLYNEUX, 38 Bridge Street, Sydney.

POLKINGHORNE, HERBERT, "Lochwinnoch," Bradley's Head Road, Mosman.

PRICE, BENJAMIN ELYSTAN, "Wanstead," Bradley's Head Road, Mosman.

ROSE, REV. HERBERT JOHN, The Rectory Strathfield.

ROSS, DR. CHISHOLM, 155 Macquarie Street, Sydney.

ROSS, WILLIAM F., "Fernilost," Ellamotta Street, Mosman.

SCAMMELL, GEORGE V., 18 Middle Head Road Mosman.

SCOTT, DONALD HYDE, 58 Pitt Street, Sydney.

SHARP, H. W. RAMSAY, Box 926 G.P.O., Sydney.

SHARP, DR. W. A. RAMSAY, 175 Macquarie Street, Sydney.

SHIPWAY, PHILLIP, 32 Bradley's Head Road, Mosman.

SIMPSON, GEORGE MORRIS, "Stonehenge," T.P.O. North Line, N.S.W.

SIMPSON, JAMES, 81 Pitt Street, Sydney.

SIMS, ALBERT, 58 Pitt Street, Sydney.

SMITH, R. DUNDAS, 30 Bradley's Head Road, Mosman.

STREET, MR. JUSTICE, Judge's Chambers Supreme Court, Sydney.

VINCENT, THOMAS, Dunlop Station, Louth, N.S.W.

WALKER, GEORGE WASHINGTON, Box 17 King Street Post Office, Sydney.

WATKINS, DR. SYDNEY COLLINGS, Hornsby.

WHEELWRIGHT, A. H., "Rosedale," Narara, Crookwell.

WHITE, CECIL ALBAN, "Winbourne," Tom Street, Rose Bay.

WILLIAMS, WILLIAM JOHN, 5 Effingham Street Mosman.

WILLIS, THOMAS CHARLES, "Araluen," Bay View Avenue, Mosman.

WILSON, ROBERT CRIGHTON, Box 49 G.P.O., Sydney.

ASSOCIATE MEMBERS.

BARKER, GEORGE HERBERT, 225 Albert Street, Brisbane, Queensland.

DEBIS, ARTHUR, Marlsbury Road, Normanhurst.

KEANE, JOHN HENRY, Waverley, Church Street, Canterbury, N.S.W.

LEACH, DR. J. A., "Eyreccourt," Canterbury, Victoria.

DE LITTLE, MRS. CECILIA E. A., "Nardoo Mia," Temora, N.S.W.

MARSHALL, TOM C., Queensland Museum, Brisbane.

THOMAS, JAMES FRANCIS, Tenterfield, N.S.W.

Mr. KELSO KING has become a Life Member.

ABOUT HANDS.

By CHARLES HEDLEY.

WE judge a stranger by his clothes or his behaviour, by his language or his face. From these we form our opinion of his character, his education or his position in society. But a shrewd observer does not fail to look also at his hands, since they, too, show much character. We recognise the artistic hand, the practical hand, or the negligent hand. Often a hand shows its trade or habits. How much would Sherlock Holmes deduce from looking at his friend's hand? A stain here means a cigarette smoker, a callus there means a cobbler. Any actor, to say nothing of a charlatan or a criminal, knows that it is easier to disguise the face, the voice, or the dress than the hands. Often a magistrate will direct the police to examine the hands of an accused to see if he has lately done any hard work, or not. Thus the hands may tell the true story of a man's habits or business, where other features might be misleading.

And it is the same with animals. Finding a strange animal, we examine its face and teeth and fur to ascertain its habits and relationships. But to decide for certain what he is, we must say to our new acquaintance, whether man or beast, "Hold out your hand." And then we learn the truth.

Here is a wide paw, with a web of skin from one finger-tip to the next; the Seal's hand. We know the owner for a swimmer. Here is another hand, also webbed from tip to tip, but far wider and lighter, and with slender bones no thicker than a bit of string: the Bat's hand. He is a flyer. Here is a short and muscular hand, with strong, sharp, hooked claws: the Tiger's hand. He is a slayer. And here is a thick hand, with stout, blunt claws: the Badger's hand. He is a digger. Here is a soft, slender hand, with long and supple fingers: the Monkey's hand. He is a climber. Lastly, here is a hand from which most of the fingers have been lost, and the nails of those that remain have thickened into hoofs: the Horse's hand. He is a runner.

All these are variations of a mammalian hand. But I remind you that long ages before a mammal had appeared on the earth, the Reptiles had produced the swimming hand in the turtle, the slaying hand in the crocodile, the climbing hand in the lizard, and the flying hand in the pterodactyl.

In the beginning animals were not four-footed but four-handed, as the frog, the rat and the monkey are to-day. The foot came as a special development of the hand, and just as it gained a better tread, so it lost the power to grasp.

First the animal walked flat on the soles of his feet, like a bear does. Then he improved by going on tip-toe, like a dog or a cat, and so gained the ability to run and jump better. Still progressing, he became a specialist in running, and, having turned all his hands into feet, he gradually dropped his superfluous toes one after another till he had only two left to each foot, like an antelope, or but one toe apiece like a horse. Cats and dogs have five fingers, but only four toes.

Indeed it was quite a usual event in evolution for an animal to lose some of the original five fingers or toes with which it began. The Spider Monkey, from South America, has lost its thumb, and an African monkey, the Colubus, also found its thumb superfluous, and got rid of it independently. Originally, as has just been said, the horse had five toes, and in the long series of extinct horses found fossil in America, the transition from five toes to three toes, and then to one toe is perfectly shown.

Other animals, on the contrary, make for themselves a fifth hand. Thus the 'possum wraps his tail around a bough, and then swings from it easily, as do some South American monkeys. The elephant "handles" his food with a long, flexible trunk, which, in fact, is his nose.

The kangaroo and man each independently struck out on a special line of evolution by keeping their hands on their fore limbs while developing feet on their legs.

The track of the wallaby is represented by pairs of broad arrows with here and there a brush between, where the tail swept the ground. From this print the wallaby appears to have three toes, but an examination of its foot shows a big toe in the centre and a small toe on the outside, while on the inside corresponding to the outer, are two little toes in a bundle together which act and print like one. The thumb has been lost, so the two little toes wrapped up together, represent the second and third of an original five-toed foot. The reason why these little toes are wrapped up together is because in the long ago the wallaby's ancestor used to climb trees, as its relation, the native bear, still does. Like the native bear, it used to cling to the branches with five toes, two on one side and three on the other. So in the tree-kangaroo, we have an animal whose immediate ancestors lived on the ground like other kangaroos, but whose remote ancestors lived on trees, and there acquired the "syndactyl" foot. Before that again, their ancestors had once lived on the ground.

THE AUSTRALIAN MUSEUM.—ITS ORIGIN, GROWTH AND WORK.

A LECTURE dealing with the history of this institution was delivered in the Museum Lecture Hall on 10th June, 1919, by the President of the Board of Trustees, Dr. Thomas Storie Dixson, Ch.M. The lecture was freely illustrated with lantern slides and specimens. He traced the origin of the institution back to 1827, its name being then the Colonial Museum; although the name Australian Museum occurred as a suggestion in 1828, it was not until 1835 that it came into definite use. The succession of Curators, Dr. George Bennett, Rev. William Branwhite Clarke, W. S. Wall, Dr. S. R. Pittard, J. L. Gerard Krefft, Dr. E. P. Ramsay, and Robert Etheridge, jr., and their special activities were dilated upon, and the gradual building up of the fine collections with the expansion of the galleries for their accommodation concisely related. The lecture has been printed in pamphlet form by the Trustees of the Australian Museum



E. H. ZECK, Photo.

SOLDIER BEETLES.

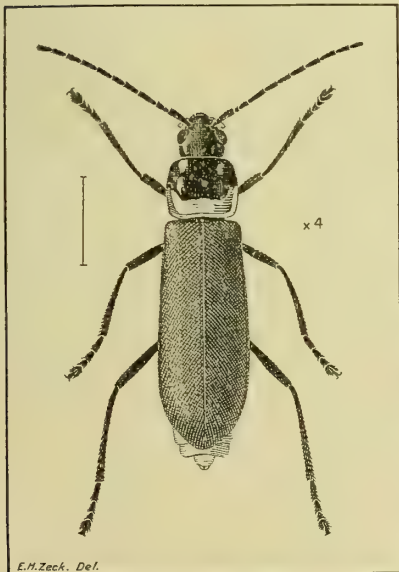
SWARMING OF THE SOLDIER BEETLE, *TELEPHORUS PULCHELLUS*.

By E. H. ZECK.

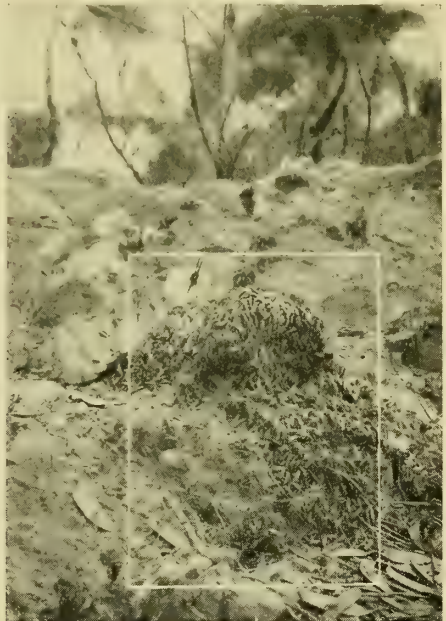
(Plate xv.)

EARLY in February, 1919, thousands of Soldier Beetles, *Telephorus pulchellus* Macleay, were observed swarming in numerous groups by the roadside above the falls at Katoomba, New South Wales. One side of the road was formed by a low cutting about two feet high, while the other, which sloped quickly away to the gully which runs into the falls, had been banked up with stones and earth.

Numerous holes and crevices in the sloping bank of the low cutting were seen to be entirely filled with the beetles, while on the opposite side of the road they were swarming over stones and climbing up into the tussocks of grass. Many others were in flight, while large numbers, which had evidently been wandering across the road, lay crushed upon the ground, having been run over by passing vehicles or walked upon by pedestrians.



Soldier Beetle, *Telephorus pulchellus*.



A Swarm of Soldier Beetles.

The accompanying photograph represents one of the stones covered by a mass of the beetles, and gives some idea of the enormous number of specimens that were present. Besides the larger masses, numbers of smaller groups were scattered about, some consisting of many, and others of only a few specimens. From a little distance these groups had the appearance of dark green moss upon the stones.

In his "Australian Insects," p. 168, Mr. W. W. Froggatt says :—"This beetle sometimes appears in great numbers ; I have seen the *Melaleuca* scrub on the Blue Mountains black with them." The species is also referred to by Mr. A. M. Lea in "Insect and Fungus Pests," as an enemy of the Codlin Moth as follows :—"Another species known as *Telephorus pulchellus*, occasionally eats codlin grubs, and many species of the same genus have been recorded as attacking them elsewhere."

These Soldier Beetles have a very soft integument, and belong to the same family as the Fire-flies and Glow Worms, the Malacodermidæ. The specimen shown in the accompanying enlarged figure is a typical example, and the following is a brief description of it.

Dorsal surface.—Head black, covered with minute hairs. Antennæ almost black, somewhat lighter at the joints, pubescent. The larger anterior portion of the prothorax black, the remainder bright yellow ; lateral margins forming an upturned flange, which is most distinct on the yellow portion. The entire surface is covered with small hairs. Both the head and prothorax are glossy. The elytra, which do not cover the last segments of the abdomen, are metallic bronze green ; in many of the darker specimens they are olive green. They are pitted, and covered with minute hairs. Exposed tip of the abdomen bright yellow.

Ventral surface.—Head black, prothorax and mesothorax bright yellow. In the centre of the metathorax there is a darker portion extending from the posterior pair of coxæ. Abdomen bright yellow. Entire ventral surface covered with minute hairs.

Legs black, covered with hairs which, in some lights, give them a reddish appearance. Length of the specimen described and figured, 14 mm.

NOTES ON THE PLUMAGE-DISPLAY OF THE BIRDS OF PARADISE IN TARONGA PARK.

By A. S. LE SOUEF, Director, Taronga Park.

SEVERAL species of Birds of Paradise have been successfully acclimatised in two aviaries in Taronga Park for the past three years. These have proved quite hardy. For the greater part of the day they sit under cover and in the darkest portion of the enclosure, only showing themselves to any extent in the early morning and in the evening about an hour before sundown ; at these times they are most active, flying rapidly round the aviary. Their call notes can be heard at almost any time of the day, especially those of the Red Plumed and the Six-wired Birds.

The moulting of the Birds of Paradise seems to be a rather more serious affair than with most other birds. The feathers start to fall in November and are generally all out by January. The birds at this time are more retiring than usual, and their call notes and "displays" are not indulged in. When the young feathers are growing during February and March the birds indulge in sunning themselves all the morning, often sitting in strained and twisted postures in order to let the sunlight play

on some special feathers. The most active in this direction is the "Magnificent Bird of Paradise," which works the breast and nape muscles so that the ornamental tufts are raised and depressed, spread and contracted. As the feathers become fully developed, the birds keep more and more to the shade and avoid sunlight; this is specially noticeable in the case of the Rifle Birds, which rarely leave cover.

COUNT RAGGI'S BIRD OF PARADISE.

This bird takes a horizontal position on a bough and erects the side plumes over the back sometimes putting the head round and through the plumes. Its call note is peculiar, one cock bird leading off with three loud short notes, after which the others join in with a second note, which is longer, loud and clear, and repeated several times; the sound resembles "chuck, chuck, chuck—wahoo, wahoo, wahoo." This is heard frequently throughout the day when the birds are in full plumage.

RUDOLF BLUE BIRD OF PARADISE.

The male Blue Bird hangs head downward on a bough on which the hen is sitting, and extends his side plumes while working the body with a rhythmical movement, and uttering a subdued croaking in unison therewith. The hen has not been observed to take any notice of the charmer.

MAGNIFICENT BIRD OF PARADISE.

Though only a small species, the plumage-display of the male bird is elaborate and very frequently performed. It consists of two distinct movements in which the appearance of the body is quite altered. The ordinary pose of the bird is rather dumpy, with the head sunk into the trunk and the beak pointing almost straight upward. The first change consists of erecting the yellow crest on the lower neck and depressing the breast and side plumes so that the bird looks long and thin and as if wearing a full bottomed skirt. This posture is suddenly altered by depressing the neck crest and extending the plumes on the cheeks, neck and breast laterally, so that the shape becomes oval; the mouth is opened and shows the shining green gape.

SIX-WIRED BIRD OF PARADISE.

This species acts in a somewhat similar way to the Bower Birds. It is fond of playing about on the ground, and selects a position at the base of a shrub where it follows a beaten track, strutting backwards and forwards and sometimes playing with a small stick; it occasionally puffs out the breast plumes laterally and erects the head plumes. This seems to be done more for amusement than to charm the hen.

KING BIRD OF PARADISE.

This beautiful species, the gem of the smaller kinds, is rather shy and does not like performing in public; so far the male has only been seen to erect and ruffle the breast plumes and to flutter his scarlet wings.

A SIMPLE METHOD OF PREPARING CRANIA.

By HEBER A. LONGMAN, Director, Queensland Museum.

OWING to the prevalence in Brisbane of the cosmopolitan little Brown Ant, *Pheidole megacephala*, Fabr., a convenient and expeditious method of preparing osteological specimens is available, especially in the warmer months. These ants have a predilection for animal tissue, and apparently appreciate the old adage that the nearer to the bone the sweeter is the meat. They are present in such numbers that their services can be utilised on quite a large scale when specimens are required. Should it be desired to prepare the skull of a small mammal, or even a complete skeleton, the specimen should first be boiled until the meat is soft enough for the major portion to be readily removed by hand or by forceps and scalpel. The specimen should then be placed on a board under a suitable wire-cover to prevent depredations by wandering cats or rodents, and left on the ground in the vicinity of a nest of ants—there is no difficulty in finding nests in Brisbane suburbs. The ants work best in the dark, when they simply swarm over the bones. The amount of material they remove in twenty-four hours is surprising.

This process has the advantage of leaving uninjured delicate or filamentous processes. The interstices and foramina are thoroughly cleaned out and the bones are left perfectly clean. Exposure to sunlight will subsequently dry and bleach them. By this method the skull of a small mammal, a bird, or a fish, can be made available for identification within forty-eight hours, and the obnoxious and lengthy process of maceration is rendered unnecessary. It almost rivals the trypsin process as described in the "Museum Journal" for February, 1919, by Miss K. F. Lander.

The only essential is to boil the specimens in order to prevent the meat from mummifying and becoming too hard, and in the case of large crania, from which a considerable amount of meat has to be removed, another boiling on the second day may be of advantage.

A large number of mammalian, reptilian and other crania have been prepared for the Queensland Museum by this simple method.

AVIARY NOTES ON THE PECTORAL RAIL, *HYPOTAENIDIA PHILIPPENSIS*, L.

By T. C. MARSHALL.

ON the 28th of December, 1917, whilst out catching King Quail, I had the good fortune to meet with this interesting bird at Harrisville. A large patch of oats was being cut at the time, and the noise of the reaping-machine frightened out a pair of rails, which flew away across the creek. Immediately after their departure I heard the peculiar "slate-pencil clack" of young birds from several directions, and after a little while succeeded in locating a little chap, which I chased out on to the ploughed ground, and quickly ran it down. In this way I managed to catch five, but though others were heard in the vicinity, I could not see them.

They were curious little chaps, not unlike day-old black orpington chicks, except that their legs and bills were much stouter and stronger. I managed to get them all safely to Brisbane, but two died a few days later. In less than a week the remaining three had grown fully twice as large as when first obtained. About the 20th of January, 1918, a few whitish barred feathers appeared; the black down had turned to a dirty brown, and appeared as though there were barely enough of it to cover the bird. On the 24th of January the buff band of the adults was plainly visible on all three birds, and feathers were rapidly taking the place of the down. About the end of the month they were perfect birds, strutting about the aviary and giving the peculiar jerk of the tail, while uttering their loud "clack" at regular intervals.



Pectoral Rails.

They are now fairly tame, and will approach one to take a worm from the hand. But woe betide a bird approaching them whilst feeding; they do not hesitate to attack it with both beak and wings, and at the same time ruffle the feathers of the neck like the hair on the tail of a cat in a fright. Only one inmate of the aviary (a Dragoon Bird, *Pitta strepitans*) appears to be their master. They will not venture too near him unless his mouth be full of worm, when taking a mean advantage they fearlessly approach and tug the dainty morsel from his mouth. They are not particular as regards food, eating mostly worms and panicum-seed, varied with a little bread and milk or apples, and occasionally at night they catch a mouse.

They appear to be nocturnal to a certain extent, as on a moonlight night they may be seen walking about, feeding and bathing. They are very fond of this last, and may be seen taking a dip several times a day. After a bath they spread the tail and droop the wings as does a turkey-cock, and strut about until quite dry again.

I should imagine that Pectoral Rails do most of their flying under cover of night, as my captives have often called down others which have been passing over the town at night. We often see wild birds running round the yard and chatting for a little while with the tame ones, after which they leave us as suddenly as they came.

My birds never sleep in the grass around the pond, but always choose the highest perches. My several attempts to breed from them have so far been met with failure. The hen bird will lay two or three eggs, but will then suddenly stop and refuses to sit.

THE SPINE-TAILED SWIFT, *CHAETURA CAUDACUTA*.

By H. E. FINCKH.

STROLLING round my garden on the morning of the 21st of January, 1919, I noticed a Spine-tailed Swift, *Chaetura caudacuta*, hanging on a low branch of a shrub, and as it made no attempt to fly from my approach I had no difficulty in securing it. So far as I could ascertain it showed no signs of injury, though its eyes appeared to be very dull. Thinking the bird could not rise, I threw it into the air, but though it made an attempt to fly it could only manage a few yards, and then landed on the lawn.

I could not hope to be able to keep it alive in one of my aviaries, but thought I would endeavour to feed it till it gained strength and then liberate it, trusting that it might pick up company on its flight to northern regions. So I put the bird into an aviary, one side of which consisted of the stone foundation of my cottage. I offered it as food some meal-worms, the larvæ of the beetle *Tenebrio molitor*, which it accepted readily, taking about a dozen a day. It would climb up to the top of the wire netting from the ground and hang there amongst the branches of a climbing Ficus; it always supported the body with its tail, and remained for hours in this position. After a few days the bird appeared to be gaining strength, so I gave it another chance of flight. It flew some fifty yards, and then came to the ground; so it went again into the aviary.



Spine-tailed Swift clinging to a Vertical Stone Wall.

On the following morning I found it hanging on the roughly-masoned sandstone wall. I hurried for my camera and exposed two plates through the door of the aviary to get the accompanying side-view; then in all haste I cut a hole in the front wire and obtained the back-view here reproduced. There was no need for such haste, however, as the bird remained in this position without moving for the next two hours, and on several occasions I again found it hanging on the wall. It still took food and water, but nevertheless died after a week's confinement.

The photographs clearly show how the tail is used to support the body when hanging to a wall. The body does not lie flat against the wall, for though the neck and the chest do so, the lower parts are forced away by the drawing up of the tail to obtain support. The eight tail feathers, which are spread, hardly touch the wall except at the very end. The sharply-pointed spines of each do all the supporting, and the two middle feathers are stronger and the spines much heavier than those of the remaining six.

I should mention that my friend, Mr. Thos. Steel, F.L.S., kindly preserved this bird for me by first soaking it in a dilute formalin solution and then drying it. This method of preserving natural history specimens is well worth consideration, since in this case the appearance of the bird is exactly as it was when it died.*

LIFE HISTORY OF THE FISH, *GALAXIAS ATTENUATUS*.

By W. J. PHILLIPPS, Dominion Museum, Wellington.

FROM time to time much has been written, and a great deal of discussion has taken place regarding the life history of *Galaxias attenuatus*, the Jolly-tail or Eel-gudgeon of Australia, and the Minnow of New Zealand. Even so recently as 1916 Meek (p. 147) has not been willing to admit the statements of various authors that the species spawns in the sea. Referring to a paper by McCulloch (1915, pp. 47-49), he states that the results of that author's investigations are not conclusive; and considers it is evident that the young of about the size figured by McCulloch migrate to the sea, at which time they are denatant.

Hutton (1872, p. 60) was the first to note that *G. attenuatus* spawned in the sea, but others interested in the subject were dubious about accepting his statement, since it relegated the species into a class of its own, differing from all others of the genus by making a catadromus migration.

Perhaps the most interesting observations were made by Clarke, 1899, pp. 78-79. He says:— "*Galaxias attenuatus* periodically descends to the sea in January, February and March, where it spawns, returning in March, April and May. The young begin to make their appearance in the rivers sometimes as early as the end of June, but they definitely commence to arrive in August, the shoals increasing in size and number in September and October. At the time of the advent of the fry I have frequently, and at several places, seen large shoals of the 'inanga' at sea, and have caught specimens in verification, and have constantly observed them washed up by the breakers on to the beaches near the mouths of large rivers, evidently when skirting the coast to enter them."

Regan (1914, p. 41) has given the following interesting reference to this species and its allies:— "Much has been made of the distribution of the Galaxiidae and Haplochitonidae, for some time regarded as freshwater fishes found in southern Australia and Tasmania, New Zealand, and the southern part of America. It is now known that *Galaxias attenuatus*, the only species common to all these regions,

* See Aust. Naturalist, vol. iv, pt. 7, p. 99 (1919).

breeds in the sea. In the "Scotia" report I have shown that these two families are Salmonoids related to the Osmeridæ, and their marine origin may be regarded as certain. Like the northern Salmonoids, they are establishing themselves in fresh water, and it is interesting to note that *Galaxias* occurs at the Cape and even New Caledonia, where, like the Trout of Algeria, it remains as the witness of a glacial epoch."

A study of the life history of *G. attenuatus* makes it apparent that the species need not have occurred in its present specific form during that period prior to Tertiary times, in which land-connection is considered by some writers to have persisted between New Zealand, Antarctica and Australia; or even as late as the Miocene, in which the land-connections between New Zealand, Antarctica, and South America are supposed to have broken down. For it appears that the larval *G. attenuatus* is capable of a transoceanic migration, and has within a comparatively recent date been distributed to its various habitats by Antarctic currents.

In New Zealand the larval form enters into the category of edible fishes as White-bait, the Maori term for the species at this stage being *Inanga*. The ancient Maori was a thorough naturalist, and much that has been unravelled by Europeans during the last fifty years was known to him centuries ago. Best (1903, p. 77) has given the Maori version of the migrations of the *Inanga* in the Bay of Plenty district, but as the story is told in the quaint mytho-poetical manner peculiar to the Maori, I have extracted only the essential parts in the following note:—

On the nights *Turu*, 16th, and *Rakau-nui*, 17th, of the ninth month of the Maori year (the middle of February to the middle of March), the *Inanga* begin to migrate to Wainui (the ocean). There are three migrations, the second taking place during the Autumn, and the third when a star known as *Takero* is seen, the migration being known by that name. The *Inanga* produce their young in salt water, and leave them there to be dashed about by the waves. In the months *Matahi* (June to July) and *Marauroa* (July to August), the *Hiwi* (another name for the parent fish) return to fresh water; but not yet the young. People see them returning, and observe they are thin and light. Then the nets and pots are set at the weirs, and great numbers are taken. The young ones do not come up the rivers until the fourth month of the Maori year (the middle of September to the middle of October).

Evidently the *Ngai Tahu* (South Island Tribe) also recognised three separate migrations of the Minnow, as I have recently been informed by Mr. Best that this tribe applies the term *Matuaiwi* to the second migration of the *Hiwi*.

The following account of the return journey of the Minnow in the Clutha River at Otago has been supplied to me by Mr. H. Beattie, who relates the story as he had it from an old native:—"They return up the river in long columns, leaving the water at its mouth white with spawn. *Mata* was the name of the very young *Inanka* (or *Inanga*), and they were caught with *Kaka* (nets) sometimes a chain long. A lagoon near Waikouaiti was called *Mata-Inanka* because the Maoris caught very small *inanga* there." I may here add that the tidal reach of the Clutha River is about twelve miles inland, and that this record of the Minnow spawning at the mouth of the river is refuted by all experienced fishermen who have fished in the tidal estuaries of our larger rivers.

The *inanga* enter a river only at full tide; immediately the tide commences to ebb they disappear either up stream or back to the ocean. During September, 1918, while visiting Paremata, seventeen miles north of Wellington, I noticed a shoal of semi-transparent fishes entering a small stream from a lagoon which is partly detached from the sea, and making their way up against the current. I followed the shoal for some distance, and later was fortunate in securing a specimen which proved to be an immature example of *Galaxias attenuatus*. I was informed by a resident that a month later much larger shoals run up stream, most of which are eaten by the eels and trout.

A brief summary of the life history of this species may be given as follows :— It migrates from the streams and rivers to the sea between some date after midsummer until after autumn. Whether three separate migrations can be distinguished or not remains yet to be proved. Clarke makes use of the term "periodically," implying that the migration seawards of all individuals does not necessarily take place at the same time. Towards the end of winter the parent fish, which have spawned in the sea, return to fresh water. The young appear off the coasts in the early spring months, but escape observation on account of their transparency. These young enter the rivers and streams around the coast until about the end of November, when a marked decrease in the supply of commercial whitebait becomes apparent.

The following is a short bibliography of the most important papers on the species :—

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NOTE ON THE MOUTH-PARTS OF LICE.

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(With a Figure in the text.)

IN the course of an account of the mouth-parts in the Body-louse, *Pediculus humanus* L. (Harrison, 1916), I endeavoured to bring these structures into correlation with those of the Mallophaga, a group of orthopterous origin. Such an interpretation is quite contrary to the generally accepted view, which would ally the sucking lice—Siphunculata—with the Hemiptera. The most recent expression of this latter view is that of Enderlein (1904, 1905), who finds no difficulty in homologising the piercing apparatus of the louse with that of the bug. In my paper, quoted above, I have criticised Enderlein's views, and set out my own, at some length.

At this time I was acquainted with only one species of Mallophaga which suggested a condition in any way intermediate between biting and sucking mouth-parts. This was *Philandesia townsendi*, a parasite of the South American rodent, *Lagidium peruanum* Meyer, described by Kellogg and Makayama (1914). In their diagnosis of the genus (1914, p. 198), the authors write :—

"Mouth-parts (Text-fig. i.) of unusual type, the mandibles being long and slender and the other mouth-parts, together with the hypopharynx and pharyngeal skeleton, forming a sort of grasping tube or furrow."

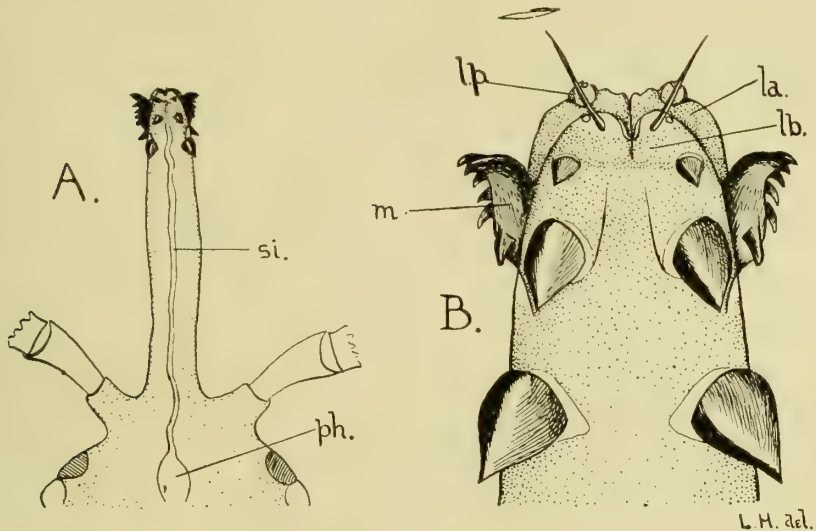
I have since received, through the kindness of Mr. G. F. Ferris, of Leland Stanford University, specimens of *Philandesia*, and am convinced of the importance of this species as an intermediate type, the mouth-parts of which are modified in the direction of sucking. I have not yet, however, had the opportunity of making a detailed examination of the mouth apparatus.

A second point of interest in connection with *Philandesia* lies in the fact that it is a two-clawed Amblyceran parasite of mammals. Outside the family *Boopidae*, confined to marsupials of the Australian region, only one other such genus is known, namely *Trimenopon*, Cummings (1913), also from a South American rodent, which I have included (1916 a, p. 31) with *Philandesia* in a family, *Trimenoponidae*. A third family, *Gyropidae*, of Amblycera, is also found upon mammals, and again almost entirely upon American rodents.

The peculiar distribution of these three families of mammal parasites, which are more nearly related to one another than to the bird-infesting Amblycera, led me to question whether the American forms might not be derivatives from the American marsupial fauna, from which no Mallophaga have been described. In order to try and settle this point, I examined a number of skins of American marsupials in the British Museum, and was successful in obtaining from two species of *Peramys*, a small rodent-like marsupial, a Mallophagan form closely related to *Philandesia* and *Trimenopon*, but generically distinct. As this occurred in fair numbers, there is no reasonable doubt but that it is an actual parasite of the genus *Peramys*. The only other Mallophagan found during the examination of skins of several species of marsupials, was a single *Gyropus* from *Metachirus*, upon which no conclusions can safely be based.

The chief interest of the new form centres in its mouth-parts, which differ from those of *Philandesia*, but which also show an intermediate condition. The mouth is a transverse slit, the labium, notched in the middle, but not grooved as in *Philandesia*, completely covering the weakly chitinated mandibles.

It is possible that a further examination of American marsupials in the field will produce a variety of interesting forms, which may support the suggestion made here as to the possible origin of Amblyceran parasites of American mammals from parasites of the marsupials. More pertinent to the present discussion is the fact that two of these forms, while still possessing mandibulate mouth-parts, exhibit a condition in which the mandibles have undergone at least a partial loss of function, and have become enclosed within the buccal cavity. I have shown (1916) that mandibles are present in young Body-lice, and that they persist even in the adult stage in some lice of seals. I do not, of course, suggest that *Philandesia* and its newly-discovered ally are stages in the line of descent of the sucking lice from their mandibulate relatives. But these two biting lice seem to me to afford some evidence of how a transition from the biting to the sucking type may have taken place.



Another insect which must be taken into consideration is the elephant-louse *Haematomyzus elephantis* Piaget. This insect is, in most of its characteristics, a typical sucking louse. Its position has never been called in question, such extreme modifications as it does show on a superficial examination being attributed as adaptations enabling it to live on its particular host. But an examination of the mouth-parts of *Haematomyzus* (Text-fig.) shows at once that these differ very markedly from those of all other sucking lice.

Unfortunately my only material of this louse comprises a male and a female cleared in potash and mounted. I am unable, in consequence, to examine the mouth-parts in section; but certain outstanding features can be clearly made out in the mounts.

Fig A. represents the proboscis and forepart of the head of *Haematomyzus*, magnified 100 diameters, the bases only of the antennæ being indicated. The only chitinous structure appearing in the lumen of the proboscis is the narrow siphon, or sucking-tube (*si.*), which is continuous behind with the pharynx (*ph.*). There is no trace of any such diverticulum as occurs in all other Siphunculata, with its contained piercing organs which Enderlein homologises with hemipterous mouth-parts.

An examination of the distal end of the proboscis under a higher magnification (Fig. B., magnified 600 diameters) explains the reason, as the mouth parts exist, modified and, in part, reduced, about the mouth opening. The latter is bounded dorsally by a curved plate (*lb.*), slightly bifid at its anterior end, which bears two sensory bristles, with three pairs of strong chitinous denticles, increasing in size from before backwards, which are set in articular areas, and are described by Piaget (1880. p. 658) as movable. This plate appears to represent labrum *plus* clypeus, the boundary between the two not being demarcated. Laterally the mouth is bounded by two heavy chitinous pieces, showing two series of hooks, a dorsal and a ventral, curving outwards and slightly backwards, the piece of either side being movably hinged. It is not possible to state with certainty what these appendages represent, but they may be fused maxilla and mandible, an interpretation suggested by the double series of hooks; or may consist of mandible or maxilla alone. The ventral boundary is formed by a curved plate (*la*) deeply bifid in the middle, each lobe bearing a rudimentary palp (*l.p.*) exactly like those of Mallophaga. This plate is represented in the figure as projecting beyond the labrum, but, in reality, it is conterminous anteriorly with the latter, projecting a little beyond it laterally. There can be no doubt that this plate represents the labium. It bears upon its ventral surface strong paired denticles which are not indicated in the figure.

Haematomyzus, consequently raises some interesting questions in connection with the mouth-parts of lice. First we may ask whether it be a louse at all. I can see no reason for doubt upon this point. Piaget, its discoverer, had none. Enderlein, who has devoted a great deal of attention to the systematics of lice, has expressed no doubt, and he is responsible for creating the family *Haematomyzidae* to contain it. Fahrenholz, another modern worker on the Siphunculata, who has assuredly examined the form, as he has described a variety (1910, p. 67), has not raised the point of its erroneous inclusion.

Haematomyzus would seem, therefore, to be a louse. Why, then, does it differ so remarkably, as regards its mouth-parts, from other Siphunculata? *Haematomyzus* pierces with the whole of its proboscis, which is simply the anterior part of the head drawn out into a long tube, bearing terminal mouth-parts; while in other lice the piercing is done by slender stylets protruded from a pocket beneath the pharynx. It seems to me that *Haematomyzus* is a primitive form, as I should expect from its host, derived from an ancestral louse group which must have had a palpigerous labium and other fairly typical mouth-parts. If it be claimed that it is not primitive, but highly adapted to a special host habitat, then it certainly cannot have been modified from any group of insects with hemipterous mouth-parts, for it is impossible to conceive a reversion from the highly specialised condition of the bugs to that of a palp-bearing labium of a type so characteristic in Mallophaga.

Specialised and modified as it may be, *Haematomyzus* seems to me to afford further justification for my reuniting the Siphunculata and Mallophaga within a single order, Anoplura (1916a, p. 25); and to constitute a fatal stumbling-block to the idea of Hemipterous homologies.

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CHECK-LIST OF THE FISH AND FISH-LIKE ANIMALS OF NEW SOUTH WALES.

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(By permission of the Trustees of the Australian Museum.)

PART I.

THOUGH there are already several lists of the "Fishes" of New South Wales, they do not enable one to identify the numerous species unless one has access to a well stocked library. The purpose of the present list is to overcome this difficulty, and it is hoped that the accompanying keys and illustrations will indicate the identity of any recorded from the waters of this State.

Five hundred and eighty-eight species are at present listed from both the marine and fresh waters of New South Wales, though a number of them are very rare here, and their inclusion is, in some cases, based upon the capture of only one or two specimens. A few others will probably prove to be synonymous with one another, but there are doubtless additional species now known only from Queensland or Victoria, whose range will be later found to extend into New South Wales. As at present known, there are about 1900 Sharks, Rays, and Fishes recorded from Australian waters, so that the fish fauna of this State would appear to include approximately a third of the total.

The marine fish fauna of New South Wales is made up of two distinct elements, one consisting of tropical fishes which have extended their range southward from Queensland, and the other of southern species ranging northward. The northern forms occasionally straggle southward of Port Jackson, entering the cooler latitudes by way of a warm current which sweeps down from Queensland during a certain portion of the year. The general temperature of our waters, however, appears to be more favourable to the southern species, which constitute the greater portion of our fish fauna.

Illustrations.—The illustrations are in almost every case miniature reproductions of the figures quoted; with few exceptions a typical species of each genus is figured, and when a genus includes several and varied species, two or more figures are supplied. A reader wishing to identify any specimen may therefore turn over the plates until something resembling it is found; he can then refer to the number in the text corresponding to that of the illustration, which will direct him to simple keys indicating the specific characters of the allied species.

Acknowledgments.—For the preparation of the excellent photographs which compose the plates, I am greatly indebted to Mr. T. C. Roughley, who has spared no pains to overcome numerous difficulties in their production; stains in the paper of the older plates, folds and other surface irregularities, and conflicting colours, have each presented their troubles, which he has consistently disposed of.

I have further to gratefully acknowledge the loan of numerous originals of the figures quoted, with permission to republish them in reduced form; references to the publications in which they originally appeared are given throughout the text. The greater number of these have been lent by the Trustees and the Director of the Australian Museum, and others by the Director of the Queensland Museum, and the Director of the South Australian Museum; I am similarly indebted to the Councils of the Linnean and Royal Societies of New South Wales. Likewise, equally grateful acknowledgment is here rendered to the numerous authors of the papers quoted, whose figures have been copied on the accompanying plates.

Finally, I owe much to the Council of the Royal Zoological Society of New South Wales for undertaking the expensive work of publication.

Keys, and How to Use Them.—Though the accompanying keys may at first sight appear involved, a little practice in their use will prove them to be quite simple. The letters before each section are to be regarded as mere *symbols without alphabetical value*, which might be replaced by any other set of symbols. The divisions and subdivisions in the keys are always alternative to one another, so that if a species does not have the characters ascribed to any section denoted by a single letter, it should be compared with those in the alternative section denoted by the same letter in duplicate. Thus, if the specimen does not fit into section A of a key, its characters will probably be found under section AA; it may then be further restricted by comparison with sections under AA—say, H, for example, and if it is found to differ from the characters there denoted, it should be compared with HH, and so on. The relative inseting of the various divisions of the keys further indicates their alternative characters, and also serves as a guide to the subdivisions included within them.

Key to the larger divisions of the Fish-like Animals.

- | | |
|--|--|
| A. Cranium wanting. | LANCELET. Subphylum <i>Acrania</i> or <i>Cephalochordata</i> (No. i only). |
| AA. Cranium present. | Subphylum <i>Craniata</i> or <i>Vertebrata</i> (No. ii. and onward). |
| B. Nasal apparatus single and median; no lower jaw. | LAMPREY. Class <i>Cyclostomata</i> (No. ii. only). |
| BB. Nasal apparatus paired; lower jaw present. | |
| C. Skull without (<i>Plagiostomi</i>) or with only a rudimentary (<i>Holocephali</i>) operculum; | |
| males with paired intromittent organs. | SHARKS and RAYS. Class <i>Elasmobranchii</i> (Nos. iii.-xxv.). |
| CC. Skull with an operculum on each side; males without | |
| paired intromittent organs. | FISHES. Class <i>Pisces</i> (No. xxvi. and onward). |

LANCELETS. Subphylum ACRANIA or CEPHALOCHORDATA.

I. Family BRANCHIOSTOMIDAE.

1. EPIGONICHTHYS Peters, Monatsb. Akad. Berlin, 1876, p. 325 (*cultellus*).

- 1a. E. BASSANUS. LANCELET. *Branchiostoma bassanum*, Gunther, Voy. Alert, Zool., 1884, p. 31; *Heteropleuron bassanum* Kirkaldy, Quart. Journ. Micr. Soc. (n. ser.), xxxvii, 1895, p. 314, pl. 34, 6 (Pl. xvi).

A small semitransparent, marine animal, about 1½ inches long, which has no back-bone. It burrows in sand.

BACK-BONED ANIMALS. Subphylum CRANIATA or VERTEBRATA.

LAMPREYS and HAG-FISHES. Class CYCLOSTOMATA.

II. Family MORDACIIDAE.

2. MORDACIA Gray, List Fish. Brit. Mus., Chondropt., 1851, p. 143 (*mordax*).

- 2a. M. MORDAX. SHORT-HEADED LAMPREY. *Petromyzon mordax* Richardson, Ichth. Erebus and Terror, 1846, p. 62, pl. 38, 3-6 (Pl. xvi).

An eel-shaped animal with a suctorial mouth armed with horny teeth by means of which it rasps holes in the flesh of living fishes upon which it feeds. It is marine in its younger stages but ascends rivers to breed. Rare in New South Wales.

SHARKS, RAYS AND GHOST SHARKS. Class ELASMOBRANCHII.

- | | |
|---|---|
| A. Five to seven external gill-openings; dorsal spine, if present not erectile; teeth numerous. | SHARKS and RAYS. Subclass <i>Plagiostomi</i> (Nos. iii.-xxiv.). |
| AA. One external gill-opening; an erectile dorsal spine; teeth few. | GHOST SHARKS. Subclass <i>Holocephali</i> (No. xxv. only). |

SHARKS AND RAYS. Subclass PLAGIOSTOMI.

- A. Gill-openings on the sides ; pectorals not attached to the head ; body subfusiform. SHARKS. Order *Selachii* (Nos. iii.-xvii.).
 AA. Gill-openings on the lower surface ; pectorals attached to the head ; body discoid. RAYS. Order *Batoidei* (Nos. xviii.-xxiv.).

SHARKS. Order SELACHII.

- A. 6-7 gill openings ; one dorsal fin.
 B. No gill-openings crossing the throat, mouth inferior. Family *Hexanchidae* (No. iii.).
 BB. Margin of first gill-opening free across the throat, mouth anterior. Family *Chlamydoselachidae* (No. iv.).
 AA. 5 gill-openings ; two dorsal fins.
 C. Anal fin present.
 D. Dorsal fins with fixed spines. Family *Heterodontidae* (No. v.).
 DD. No dorsal spines.
 E. Eyes with nictitating membranes.
 F. Teeth compressed, triangular, one series functional.
 G. Head normally formed. Family *Carcharhinidae* (No. vi.).
 GG. Head hammer or kidney shaped. Family *Sphyrnidae* (No. viii.).
 FF. Teeth in bands or pavements, more than one series functional. Family *Mustelidae* (No. vii.).
 EE. Eyes without nictitating membranes.
 H. First dorsal over or behind the ventrals.
 I. Nasoral grooves present. Family *Orectolobidae* (No. ix.).
 II. No nasoral grooves. Family *Scylliorhinidae* (No. x.).
 HH. First dorsal more or less in advance of the ventrals.
 J. Caudal peduncle without lateral keels.
 K. Tail very long ; more than half the total length. Family *Alopiidae* (No. xi.).
 KK. Tail normal ; less than half the total length. Family *Carchariidae* (No. xii.).
 JJ. Caudal peduncle with lateral keels.
 L. Gill-openings moderate, teeth large. Family *Isuridae* (No. xiii.).
 LL. Gill-openings very wide, teeth small. Family *Cetorhinidae* (No. xiv.).
 CC. Anal fin absent.
 M. Body subcylindrical, pectoral fins normal.
 N. Dorsal fins with spines, snout normal. Family *Squalidae* (No. xv.).
 NN. Dorsal fins without spines, snout saw-like. Family *Pristiophoridae* (No. xvi.).
 MM. Body depressed ; pectoral fins greatly enlarged, with an anterior extension separated from the body by a notch. Family *Squatinae* (No. xvii.).

III.

Family HEXANCHIDAE.

- A. Head broad, snout broad. *Notorhynchus* (3).
 AA. Head tapering, snout narrow. *Heptranchias* (4).

3. NOTORHYNCHUS Ayres, Proc. Cal. Acad. Sci.'i., 1855, p. 73 (*maculatus*).

- 3a. N. PECTOROSUS. Seven-gilled Shark. *Heptranchias pectorosus* Garman, Bull. Essex. Inst. xvi., 1884, p. 56 ; *Heptranchias indicus* Macdonald and Barron, Proc. Zool. Soc., 1868, p. 371, pl. 33. (Pl. xvi.).

A small shark, with numerous primitive characters, reaching about eight feet in length ; the teeth are of remarkable form, and very different in each jaw. Rare in our waters.

4. HEPTRANCHIAS Rafinesque, Caratt. gen. spec. Sicilia, 1810, p. 13 (*cinereus*).

- 4a. H. PERLO. One-finned Shark. *Squalus perlo* Bonnaterre, Encycl. Meth., Ichth. 1788, p. 10 ; *H. perlo* McCulloch, Zool. Res. Endeavour i. 1, 1911, p. 2, pl. 1, I. (Pl. xvi.).

A deep water species recently taken off Botany Bay by the State Trawlers. It ranges from the Mediterranean and neighbouring Atlantic to Japan and southern Australia. It is a small species with primitive characters like the preceding.

IV.

Family CHLAMYDOSELACHIDAE.

5. CHLAMYDOSELACHUS Garman, Bull. Essex. Inst., xvi., 1884 p. 52 (*angineus*).

- 5a. C. SP. FRILLED-GILLED SHARK. *Chlamydoselachus sp.* Stead, P.L.S. N.S.W., xxxii., 1907, p. 554.

The inclusion of this widely distributed genus in this list is based upon some remains found in Port Jackson. The typical species, *C. anguineus*, is a very primitive shark first described from Japan, which grows to about six feet in length.

V. Family HETERODONTIDAE.

- A. Supraorbital ridges gradually decreasing in height posteriorly; enlarged lateral teeth not carinate. *Heterodontus* (6).
 AA. Supraorbital ridges ending abruptly posteriorly; enlarged lateral teeth with distinct keels. *Gyropleurodus* (7).

6. HETERODONTUS Blainville, Bull. Soc. Philom., viii., 1816, p. 121 (*philippi*).

- 6a. H. PHILIPPI. PORT JACKSON SHARK. *Squalus philippi* Bloch & Schneider, Syst. Ichth., 1801, p. 134; *H. philippi* McCoy, Prodr. Zool. Vict. dec. xii., 1886, pl. 113. (Pl. xvi.).

Common in the shallower waters of the southern half of Australia. Fossil remains of allied forms are known from the Carboniferous Series, and indicate that these sharks were more numerous in Palaeozoic and Mesozoic times than at present. The teeth are of remarkable form, being adapted for crushing the shell-fish, etc., upon which this species feeds. Attains a length of about four feet.

7. GYROPLEURODUS Gill, Proc. Acad. Nat. Sci. Philad., 1862, p. 489 (*francisci*).

- 7a. G. GALEATUS. CRESTED PORT JACKSON SHARK. *Cestracion galeatus* Gunther, Brit. Mus. Cat. Fish., viii., 1870, p. 416; *Heterodontus galeatus* MacL. & MacL., P.L.S. N.S.W., iii., 1879, p. 313, pl. 25. (Pl. xvi.).

Less abundant than the preceding species, but similar in both habits and appearance. The egg-cases of both are of remarkable form, being spiral, and provided with long tendrils.

VI. Family CARCHARHINIDAE.

A. Spiracles present.

- BB. A conspicuous pit above the root of the tail; subcaudal lobe very long. *Galeocerdo* (11).
 BB. No pit at the root of the tail; subcaudal lobe short. *Galeus* (12).

AA. Spiracles absent.

- C. First dorsal nearer pectorals than ventrals.
 D. Teeth serrated on the base in the upper series only. *Hypoprion* (9).
 DD. Teeth serrated on both bases and cusps. *Carcharhinus* (8).
 CC. First dorsal nearer the ventrals than the pectorals. *Prionace* (10).

8. CARCHARHINUS Blainville, Bull. Soc. Philom., viii., 1816, p. 121 (*commersonii*).

A. Teeth of both jaws serrated.

- B. Upper teeth slightly notched on the outer edge. *gangeticus* (8a).
 BB. Upper teeth deeply notched on the outer edge. *brachyurus* (8b).

AA. Teeth of lower jaw entire; upper teeth scarcely notched.

stevensi (8c).

- 8a. C. GANGETICUS. SEA SHARK. *Carcharias, Prionodon, gangeticus* Mull. & Henle, Plagiost., 1838, p. 39, pl. 13.

Grows to at least seven feet long. A ferocious species in Indian estuaries.

- 8b. C. BRACHYURUS. WHALER. *Carcharias, Prionodon, brachyurus*, Gthr., Brit. Mus. Cat. Fish. viii., 1870, p. 369; *Id.* Waite, Rec. Aust. Mus. vi., 1906, p. 226, pl. 39. (Pl. xvi.).

A common species growing to twelve feet in length.

- 8c. C. STEVENSI. *Carcharias stevensi* Ogilby, Ann. Qld. Mus. x., 1911, p. 38.

A little known species from northern New South Wales and Queensland.

9. HYPOPRION Mull. & Henle, Plagiost., 1838, p. 34 (*macleti*).

- 9a. H. MACLETI. LONG-NOSED SEA SHARK. *Id.* Mull. & Henle, *Loc. cit.*, pl. 10. (Pl. xvi.).

Only once recorded from Port Jackson; the specimen was 3 feet long.

10. PRIONACE Cantor, Cat. Malay. Fish., 1850, p. 399 (*glauca*).

10a. P. GLAUCA. BLUE SHARK. *Squalus glaucus* Linne, Syst. Nat. 10th ed., 1758, p. 235 ; *Galeus glaucus* Garman, Mem. Mus. Comp. Zool., xxxvi., 1913, p. 145, pl. 3, fig. 1-3. (Pl. xvi.).

Widely distributed over most warm seas, but not certainly known from New South Wales. Grows to 15 feet in length.

11. GALEOCERDO Mull. & Henle, Arch. Naturg. iii. I., 1837, p. 398 (*arcticus*).

11a. G. ARCTICUS. TIGER SHARK. *Squalus arcticus* Faber, Naturg. Fisch. Iss., 1829, p. 17 ; *G. rayneri* Macdon. & Barron, P.Z.S. 1868, p. 368, pl. 32. (Pl. xvi.).

A common and dangerous species reaching a length of at least sixteen feet. It is widely distributed throughout temperate and tropical seas, and often appears in our harbours and estuaries.

12. GALEUS Rafinesque, Caratt. Gen. Spec. Sicilia, 1810, p. 13 (*galeus*).

12a. G. AUSTRALIS. SCHOOL SHARK. *G. australis* Macleay, P.L.S. N.S.W., vi., 1881, p. 354 ; *Id.* McCoy, Prodr. Zool. Vict. dec. vii., 1882, pl. 64, 2.

A very common species, growing to about five feet long.

VII.

Family MUSTELICAE.

13. MUSTELUS Linck, Mag. neue Phys. u. Nat. vi., 1790, p. 31 (*mustelus*).

13a. M. ANTARCTICUS. GUMMY. *M. antarcticus* Gthr., Brit. Mus. Cat. Fish., viii., 1870, p. 387 ; *Id.* McCul., Rec. Aust. Mus., vii., 1909, p. 315, pl. 90, 3. (Pl. xvi.).

Another small and harmless species, reaching about $3\frac{1}{2}$ feet in length. The blunt, pavement-like teeth, from which this shark derives its popular name, serve to crush up shell-fish and crustaceans, etc. The young are developed within the body of the parent, and supplied with nourishment by means of a remarkable structure resembling the placenta of mammals.

VIII.

Family SPHYRNIDAE.

14. SPHYRNA Rafinsq., Indies Ittiol. Sicil., 1810, pp. 46, 50 (*zygaena*).

14a. S. ZYGAENA. HAMMER-HEADED SHARK. *Squalus zygaena* Linne, Syst. Nat. 10th ed., 1758, p. 234 ; *Cestracion zygaena* Garman, Mem. Mus. Comp. Zool., xxxvi., 1913, p. 157, pl. 1, 1-3. (Pl. xvi.).

Grows to at least fifteen feet long, and is very dangerous to man. Not uncommon in the open sea, and remarkable for the lateral expansions of the head, which bear the eyes. The young are very numerous and are born alive.

IX.

Family ORECTOLOBIDAE.

A. Sides of head with skinny lobes anteriorly.

Orectolobus (15).

AA. Sides of head without lobes.

B. Anal commencing before the second dorsal.

Parascyllium (17).

BB. Anal behind the second dorsal.

C. First dorsal behind the ventrals ; spiracle below the eye.

Brachaelurus (16).

CC. First dorsal above the ventrals ; spiracle behind the eye.

Stegostoma (18).

15. ORECTOLOBUS Bonaparte, Icon. Faun. Ital., Pesc., fasc. 7, 1834, p. 11 (*barbatus*).

15a. O. MACULATUS. WOBEGONG. *Squalus maculatus* Bonnaterre, Encycl. Meth., Ichth., 1788, p. 8 ; *O. maculatus* Ogil. & McCul., P. Roy. Soc. N.S.W., xlii., 1909, p. 273, pl. 42, 2. (Pl. xvi.).

Reaches a length of 5-6 feet. Common among rocks on the coast, where it lies in wait for its prey. Not harmful to man unless it accidentally catches a wader's foot or hand. The young are produced alive and in large numbers.

- 15b. O. DEVISI. CARPET SHARK. *Id.* Ogilby, Mem. Qld. Mus., v., 1916, p. 181; *O. ornatus* Ogil. & McCul., P. Roy. Soc. N.S.W., xlii., 1909, p. 276, pl. 42, 1. (Pl. xvi.).

A somewhat larger and more ornate species than the preceding, but with similar habits and structure.

16. BRACHAELURUS Ogilby, P. Roy. Soc. Qld., xx., 1907, p. 27 (*modestus*).

- 16a. B. MODESTUS. BLIND SHARK. *Chiloscyllium modestum* Gthr., P.Z.S., 1871, p. 654, pl. 54. (Pl. xvi.).

A small species about three feet long, which is commonly taken by rock fishermen on the coast. The young are born alive.

17. PARASCYLLIUM Gill, Ann. Lyc. Nat. Hist. N. York, 1861, pp. 407, 412 (*variolum*).

- 17a. P. COLLARE. COLLARED CAT SHARK. *P. collare* Rams. & Ogil., P.L.S. N.S.W. (2), iii., 1888, p. 1310; *Id.* Waite, Mem. Aust. Mus., iv. 1, 1899, p. 32, pl. 2, 2. (Pl. xvi.).

Plentiful in the deeper waters, where it is commonly taken by trawlers. Reaches about three feet in length. This species deposits eggs which are enclosed in oblong horny cases, and are attached to weeds by means of long tendrils at the angles.

18. STEGOSTOMA Mull. & Henle, Arch. Naturg. iii. 1, 1837, p. 395 (*fasciatum*).

- 18a. S. TYGRINUM. ZEBRA SHARK. *Squalus tygrinus* Bonnaterre, Encycl. Meth., Ichth., 1788, p. 8; *S. tigrinum* Day, Fish. India, 1878, p. 725, pl. 187, 4. (Pl. xvii.).

A tropical shark which rarely strays into our waters. It feeds upon shell-fish and crabs, etc., and grows to about six feet long.

X.

Family SCYLLIORHINIDAE.

19. HALAELURUS Gill, Ann. Lyc. Nat. Hist. N. York, vii., 1861, p. 407 (*burgeri*).

- 19a. H. ANALIS. SPOTTED CAT SHARK. *Scyllium anale* Ogilby, P.L.S. N.S.W., x., 1885, p. 445; *Catulus analis* Waite, Mem. Aust. Mus. iv. 1, 1899, p. 31, pl. 2, 1. (Pl. xvii.).

A deeper water species, often taken by the trawlers, which rarely grows above two feet long. The young are produced from eggs.

XI.

Family ALOPIIDAE.

20. ALOPIAS Rafinsq., Caratt. Gen. Spec. Sicilia, 1810, p. 12 (*macrourus*).

- 20a. A. VULPINUS. THRESHER SHARK. *Squalus vulpinus* Bonnat., Encycl. Meth., Ichth., 1788, p. 9; *Vulpecula marina* Garman, Mem. Mus. Comp. Zool., xxxvi., 1913, p. 30, pl. 7, 1-3. (Pl. xvii.).

Distributed over all warm seas, and occasionally seen off our coast. Grows to fifteen feet in length, half of which is made up of the greatly elongated tail; this last is used to splash the surface of the sea near a shoal of fish so as to frighten them together. A common idea that the Thresher attacks whales apparently rests upon erroneous observations.

XII.

Family CARCHARIIDAE.

21. CARCHARIAS Rafinesque, Caratt. Gen. Spec. Sicilia, 1810, p. 10 (*taurus*).

21a. C. ARENARIUS. GREY NURSE. *Id.* Ogilby, Ann. Qld. Mus. x., 1911, p. 37; *Odontaspis taurus* McCoy, Prodr. Zool. Vict. dec. vii., 1882, pl. 64, 1.

A very common shark on the coast, where it chases schools of fish near the beaches. It is said to occasionally attack man, and to reach a length of fifteen feet.

- 21b. C. TRICUSPIDATUS. BLUE NURSE. *Id.* Day, Fish. India, 1878, p. 713, pl. 186, fig. 1. (Pl. xvii.).

Grows to over twelve feet in length.

XIII.

Family ISURIDAE.

A. Teeth awl-shaped, with smooth edges.

Isurus (22).

AA. Teeth large and triangular, with serrated edges.

Carcharodon (23).

22. ISURUS, Rafinesque, Caratt. Gen. Spec. Sicilia, 1810, p. 11 (*oxyrhynchus*).

22a. I. GLAUCUS. BLUE POINTER. *Oxyrhina glauca* Mull. & Henle, Plagiost., 1838, p. 69, pl. 29. (Pl. xvii.).

Said to be common in Port Jackson, and to reach a length of twelve feet.

23. CARCHARODON Smith, P. Geol. Soc. Lond., v., 1837, p. 86 (*capensis*).

23a. C. CARCHARIAS. WHITE SHARK. *Squalus carcharias* Linne, Syst. Nat. 10th ed., 1758, p. 235; *C. carcharias* Garman, Mem. Mus. Comp. Zool. xxxvi., 1913, p. 32, pl. 5, 5-9. (Pl. xvii.).

A fierce and destructive species which attains a length of forty feet. It ranges over all warm and temperate seas, and has been recorded on several occasions from our waters. Fossil teeth of a closely allied species indicate that a very recently extinct relative of this shark must have reached at least eighty feet in length.

XIV.

Family CETORHINIDAE.

24. CETORHINUS Blainville, Bull. Soc. Philom. viii., 1816, p. 121 (*gunneri*).

24a. C. MAXIMUS. BASKING SHARK. *Squalus maximus* Gunner, Trondhj. Selskab. iii., 1765, p. 33; *Selache maxima* Day, Fish. Gt. Brit. & Ireld., ii., 1880-1884, p. 303, pl. 158, 1. (Pl. xvii.).

A very large, but harmless shark, attaining a length of 35 feet. It occurs in all warm and temperate seas, but has only once been noted in our waters. Its food consists of minute floating animals, which are apparently strained from the water by means of peculiar comb-like structures on the gill-arches.

XV.

Family SQUALIDAE.

25. SQUALUS Linne, Syst. Nat. 10th ed., 1758, p. 233 (*acanthias*).

25a. S. MEGALOPS. PIKED DOG-FISH. *Acanthias megalops* Macleay, P.L.S. N.S.W., vi., 1881, p. 367. (Pl. xvii.).

Abundant in somewhat deeper waters, where it is taken by the trawlers. Grows to nearly three feet in length. Though this shark is disdained as food, quantities of an allied species are imported into Australia in a smoked condition, and sold as "Smoked Haddock."

XVI.

Family PRISTIOPHORIDAE.

26. PRISTIOPHORUS Mull. & Henle, Arch. Naturg. iii. 1, 1837, p. 399 (*cirratus*).

26a. P. CIRRATUS. SAW SHARK. *Pristis cirratus* Latham, Tr. Linn. Soc. Lond., ii., 1794, p. 281, pls. 26, 5 & 27. (The figure on Pl. xvii. represents a closely allied species *P. nudipinnis*).

Very common, and growing to about four feet long. The toothed blade which forms the snout is an effective weapon of attack among the schools of herring and other small fishes upon which these sharks feed. The young are born alive, and have the teeth of the snout laid flat against the sides, so as to avoid injury to the mother.

XVII.

Family SQUATINIDAE.

27. SQUATINA Dumeril, Zool. Analyt., 1806, pp. 102, 342 (*angelus*).

27a. S. AUSTRALIS. ANGEL SHARK. *Id.* Regan, A.M.N.H. (7) xviii., 1906, p. 438; *Rhina squatina* McCoy, Prodr. Zool. Vict., dec. iv., 1879, pl. 34. (Pl. xvii.).

Common, and reaching a length of about five feet. It feeds upon crabs and shell-fish, etc., and produces its young alive. The body is depressed and flat, like that of a ray, but the gill-openings are on the sides as in the sharks.

RAYS—Order BATOIDEI.

Key to the Families of Rays recorded from New South Wales.

A. Snout produced into a saw-like blade.

Pristidae (xviii.).

AA. Snout not saw-like.

B. Head without free horn-like fins.

C. Caudal fin large, tail stout.

D. Electric organs absent or incipient, skin scaly.

Rhinobatidae (xix.).

DD. Electric organs present, skin soft and naked.

Narcobatidae (xx.).

CC. Caudal fin smaller or absent, tail more slender.

E. Tail without a serrated spine.

Rajidae (xxi.).

EE. Tail usually with a serrated spine.

F. Teeth small and numerous.

Dasyatidae (xxii.).

FF. Teeth few, large, flat and tessellated.

Myliobatidae (xxiii.).

BB. Head with two horn-like fins.

Mobulidae (xxiv.).

XVIII.

Family PRISTIDAE.

28. PRISTIS Linck, Mag. Neue. Phys. Naturg., vi., 1790, p. 31 (*pristis*).

28a. P. ZYSTRON. SAWFISH. *Id.* Bleeker, Verh. Bat. Gen. xxiv., 1851, p. 55; *Id.* Day, Fish. India, 1878, p. 729, pl. 191, 2. (Pl. xvii.).

Grows to 20 feet long, and is much dreaded because of fearful injuries it inflicts with lateral strokes of its powerful "saw." It is widely distributed, and is occasionally taken in estuaries on our coast.

XIX.

Family RHINOBATIDAE.

A. Dorsal opposite the ventrals, a subcaudal lobe; body ornate.

Rhynchobatus (29).

AA. Dorsal behind the ventrals; no subcaudal lobe.

B. Snout long, sharply-pointed and shovel-shaped; body plain coloured.

Rhinobatus (30).

BB. Snout shorter, obtuse; body ornate.

Trygonorhina (31).

29. RHYNCHOBATUS Mull. & Henle, Arch. Naturg. iii. 1, 1837, p. 399 (*laevis*).

29a. R. DJIDDENSIS. WHITE-SPOTTED RAY. *Raja djiddensis* Forskal, Descr. Anim., 1775, p. 18; *R. djiddensis* Day, Fish. India, 1878, p. 730, pl. 192, 1. (Pl. xvii.).

Grows to seven feet long, and is said to be not uncommon.

30. RHINOBATUS Bl. & Schn., Syst. Ichth., 1801, p. 353 (*rhinobatus*).

30a. R. BANKSII. SHOVEL-NOSED RAY. *Id.* Mull. & Henle, Plagiost. 1838, p. 123; *Id.* Waite, Mem. Austr. Mus., iv., 1, 1899, p. 38, pl. 3. (Pl. xvii.).

A common species growing to four feet in length.

31. TRYGNORHINA Mull & Henle, Plagiost., 1838, p. 124 (*fasciata*).

31a. T. FASCIATA. FIDDLER. *Id.* Mull. & Henle, *Loc. cit.*, pl. 43. (Pl. xvii.).

Common, and reaching a length of four feet.

XX.

Family NARCOBATIDAE.

A. Tail shorter than the disc.

B. Caudal fin large, disc broader than long.

BB. Caudal fin small; disc as long as broad.

AA. Tail longer than the disc.

Narcobatus (32).

Hypnarce (33).

Narcine (34).

32. NARCOBATUS Blainv., Bull. Soc. Philom. 1816, p. 121 (*torpedo*).

32a. N. FAIRCHILD. ELECTRIC RAY. *Torpedo fairchildi* Hutton, Cat. Fish. N. Zeal., 1872, p. 83, pl. 12, fig. 134; *Id.* McCul., Rec. Aust. Mus., xii., 8, 1919, p. 171, pl. xxv. (Pl. xviii.).

One specimen twenty-eight inches long taken in deep water by the State trawlers.

33. HYPNARCE Waite, Rec. Austr. Mus. iv. 5, 1902, p. 180 (*subnigra*).

33a. H. SUBNIGRA. NUMBFISH. *Id.* Dumeril, Rev. Mag. Zool. (2) iv., 1852, p. 279, pl. 12. (Pl. xviii.).

Not uncommon, and grows to over two feet long. The electric discharge given off by this Ray is very powerful, and serves to paralyse its prey as well as to scare off its enemies.

34. NARCINE Henle, Ueber Narcine, Berlin, 1834, p. 31 (*brasiliensis*).

34a. N. TASMANIENSIS. LITTLE NUMBFISH. *Id.* Richardson, P.Z.S., 1841, p. 22, and Tr. Z.S., iii., 1849, p. 178, pl. 11, 2. (Pl. xviii.).

Very plentiful in the deeper water off the coast, and often taken by the trawlers. Grows to a little over a foot long.

XXI.

Family RAJIDAE.

35. RAJA Linne, Syst. Nat. 10th ed., 1758, p. 231 (*batis*).

A. Upper surface smooth, with but few large spines.

AA. Entire upper surface covered with minute spines.

B. Snout produced, lower surface with minute spines.

BB. Snout not projecting, lower surface smooth.

australis (35a).

scabra (35b).

nitida (35c).

35a. R. AUSTRALIS. COMMON SKATE. *Raia australis* Macleay, P.L.S. N.S.W., viii., 1884, p. 461; Waite, Mem. Austr. Mus., iv. 1., 1899, p. 40, pl. 4. (Pl. xviii.).

Grows to 19 inches long, and is common in the deeper waters.

35b. R. SCABRA. GREAT SKATE. *Raia scabra* Ogilby, Cat. Fish. Austr. Mus. I., 1888, p. 17.

A rare and little known species, reaching 5½ feet in length.

35c. R. NITIDA. ROUGH-BACKED SKATE. *Id.* Gunther, Challenger Rept. Zool. i., 1880 p. 27, pl. 14, a.

A small deep-water species, growing to a little over a foot long.

XXII.

Family DASYATIDÆ.

A. Tail long and whip-like, no caudal fin.

B. Tail with keels or folds.

C. Dental surface of jaws straight or undulous, back more or less smooth, tail-folds narrow.

CC. Dental surface of upper jaw angular, back with rough scales, a broad fold below the tail.

BB. Tail without keels or folds.

AA. Tail moderate or short.

D. Disc subcircular, tail stout, caudal fin present.

DD. Disc very wide, angular; tail slender, no caudal fin.

Dasyatis (36).

Pastinachus (37).

Himantura (38).

Urolophus (39).

Pteroplatea (40).

36. *DASYATIS* Rafinesque, Caratt. Gen. Spec. Sicilia, 1910, p. 16 (*ujo*).

A. Tail with a small fold above as well as below.

B. Scapular region smooth, or with spines on median line only; upper surface with blue spots.

BB. Scapular region with a broad patch of tubercles; upper surface uniformly coloured.

AA. Tail with a fold below, none above.

C. Back smooth or with isolated tubercles.

CC. Back with numerous tubercles.

kuhlîi (36a).

fluviorum (36b).

brevicaudatus (36c).

thetidis (36d).

36a. D. KÜHLII. BLUE-SPOTTED STINGAREE. *Trygon kuhlîi* Mull. & Henle, Plagiost, 1838, p. 164, pl. 51, 2.

A tropical species, once recorded from the Parramatta River estuary.

36b. D. FLUVIORUM. ESTUARY STINGAREE. *Id.* Ogilby, P. Roy. Soc. Qld. xxi., 1908, p. 6; *Id.* McCul., Biol. Res. Endeavour iii. 3, 1915, p. 103, pl. 16, 1. (Pl. xviii.).

Grows to about one foot wide. Like all other Sting Rays, this species can inflict dangerous wounds with its barbed spine, which often causes blood-poisoning.

36c. D. BREVICAUDATUS. SMOOTH STINGAREE. *Trygon brevicaudatus* Hutton, A.M.N.H. (4) xvi., 1875, p. 317; *D. brevicaudatus* McCul., Biol. Res. Endeavour iii. 3, 1915, p. 102, pl. 15, 1. (Pl. xviii.).

Not uncommon in deeper water, occasionally wandering into harbours and estuaries. Grows to at least four feet wide.

36d. D. THETIDIS. BLACK STINGAREE. *Id.* (Ogilby) Waite, Mem. Austr. Mus., iv. 1, 1899, p. 46.

A little-known, though apparently common species in our deeper waters, and growing to over four feet in width.

37. *PASTINACHUS* Ruppell, Atl. Reise Nordl. Afrika, 1828, p. 51 (*sephen*).

37a. P. SEPHEN. FANTAILED RAY. *Raja sephen* Forskal, Descr. Anim., 1775, p. 18; *Trygon sephen* Day, Fish. India, 1878, p. 740, pl. 195, 2. (Pl. xviii.).

A tropical species, apparently common in the northern waters of the State. Indian specimens have measured nearly six feet across the disc.

38. *HIMANTURA* Mull. & Henle, Arch. Naturg. iii. I., 1837, p. 400 (*uarnak*).

38a. H. UARNAK. COACHWHIP RAY. *Raja uarnak* Forsk., Descr. Anim., 1775, p. 18; *Trygon uarnak* Day, Fish. India, 1878, p. 737, pl. 194, 1. (Pl. xviii.).

A tropical species, once recorded from the Clarence estuary. Grows to five feet wide, and is capable of inflicting very dangerous wounds with its spine.

39. *UROLOPHUS* Mull. & Henle, Arch. Nat. iii. I., 1837, p. 400 (*cruciatius*).

A. Tail shorter than its distance from the mouth.

AA. Tail longer than its distance from the mouth.

B. Internasal valve broadly fringed posteriorly; nostrils with broad posterior lobes; tail without lateral folds.

BB. Internasal valve with only a narrow fringe or lobules posteriorly; nostrils without broad posterior lobes.

C. Papillae behind lower jaw fewer, back uniform.

CC. Papillae behind lower jaw numerous, back white-speckled.

aurantiacus (39a).

testaceus (39b).

viridis (39c).

bucculentus (39d).

- 39a. *U. AURANTIACUS*. YELLOW-BACKED STINGAREE. *Id.* Mull. & Henle, Plagiost., 1841, p. 173, pl. 56; *Id.* McCull., Biol. Res. Endeavour iv. 4, 1916, p. 172, pl. 49. (Pl. xviii.).

Commonly taken by the trawlers in deeper water. Grows to about 16 inches wide, and together with the following species, is commonly sold as Skate.

- 39b. *U. TESTACEUS*. COMMON STINGAREE. *Trygonoptera testacea* Mull. & Henle, Plagiost., 1841, p. 174, pl. 57; McCul., Biol. Res. Endeavour iv. 4, 1916, p. 174, pl. 50. (Pl. xviii.).

Abundant on sandy flats in shallow water. Grows to about 12 inches wide.

- 39c. *U. VIRIDIS*. GREEN-BACKED STINGAREE. *Id.* McCul., Biol. Res. Endeavour iv. 4, 1916, p. 170, pl. 51.

Very commonly taken by the trawlers in deeper water. Grows to about 12 inches wide.

- 39d. *U. BUCCULENTUS*. SANDY-BACKED STINGAREE. *Id.* Macleay, P.L.S. N.S.W., ix., 1885, p. 172; *Trygonoptera bucculenta* Waite, Mem. Austr. Mus. iv. 1., 1899, p. 44, pl. 5.

A larger and common species in deeper water, growing to at least 18 inches wide.

40. *PTEROPLATEA* Mull & Henle, Arch. Naturg. iii. 1, 1837, p. 400 (*altavela*).

- 40a. *P. AUSTRALIS*. RAT-TAILED RAY. *Id.* Rams. & Ogil., P.L.S. N.S.W., x., 1886, p. 575; *Id.* McCul., Austr. Zool. i. 4, 1917, p. 89, pl. 10, 3. (Pl. xviii.).

Apparently not uncommon in our northern waters, and growing to at least three feet wide.

XXIII.

Family MYLIOBATIDAE.

41. *MYLIOBATIS* Cuvier, Regne Anim. ii., 1817, p. 137 (*aquila*).

- 41a. *M. AUSTRALIS*. EAGLE RAY. *Id.* Macleay, P.L.S. N.S.W., vi., 1881, p. 380; *Id.* McCoy Prodr. Zool. Vict. dec. vii., 1882, pl. 63. (Pl. xviii.).

Not uncommon, and attaining a width of over 4 feet.

42. *AETOBATIS* Blainville, Bull. Soc. Philom. viii., 1816, p. 112 (*narinari*).

- 42a. *A. NARINARI*. SPOTTED EAGLE RAY. *Raia narinari* Euphrasen, Vet. Akad. Nya. Handl. xi., 1790, p. 217, pl. 10; Day, Fish. India, 1878, p. 743, pl. 194, 4. (Pl. xviii.).

A tropical species; only once recorded from our waters. Grows to 6 feet wide.

XXIV.

Family MOBULIDAE.

43. *MANTA* Bancroft, Zool. Journ. iv., 1829, p. 454 (*manta*).

- 43a. *M. ALFREDI*. DEVIL FISH. *Ceratoptera alfredi* (Kreff), Macleay, P.L.S. N.S.W., vi., 1881 p. 381. (Pl. xviii.).

Imperfectly known from a single specimen, 13½ feet wide, which is preserved in the Australian Museum; several others are said to have been observed on the coast. The accompanying photograph represents the typical stuffed specimen.

Order HOLOCEPHALI.

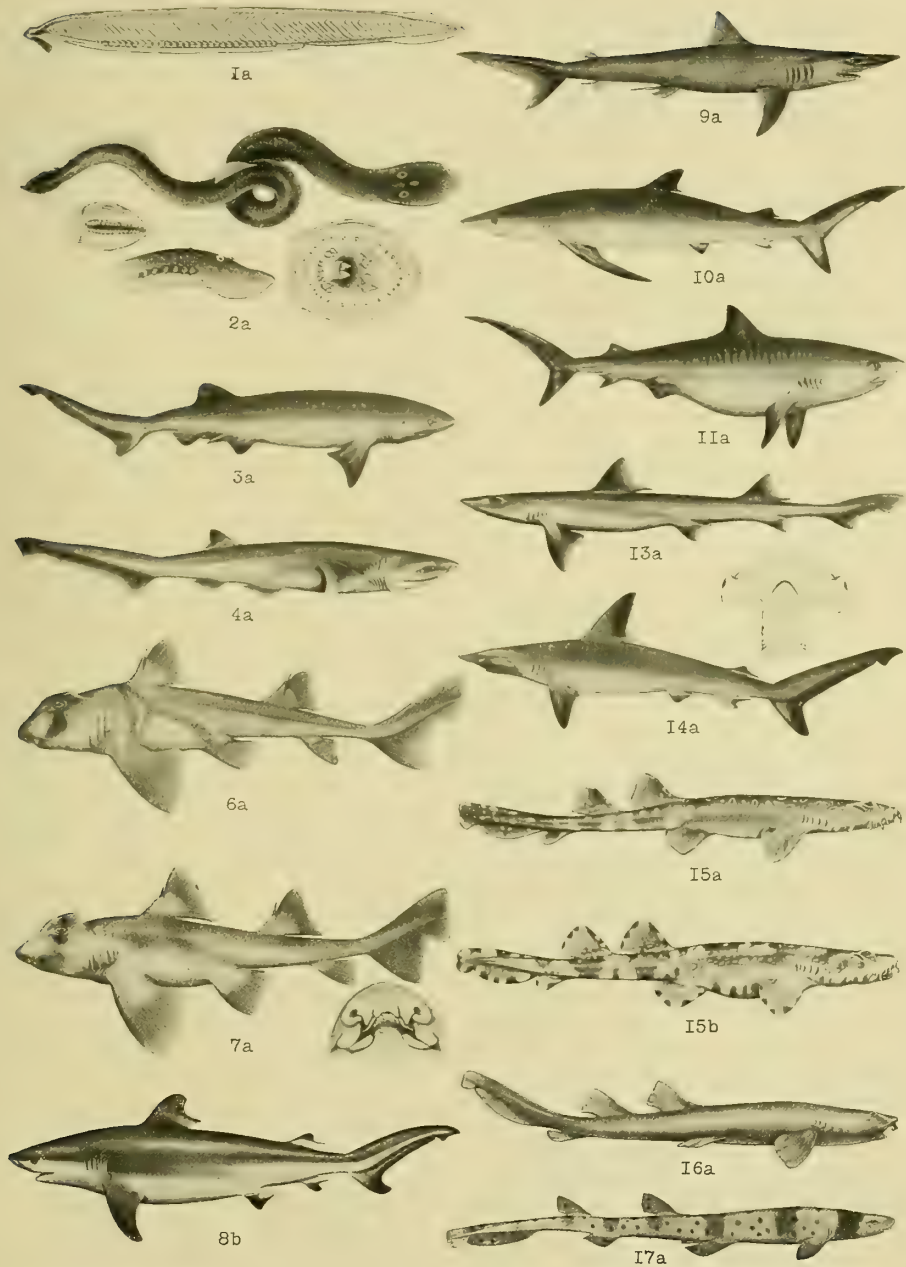
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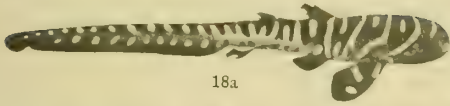
Family CHIMAERIDAE.

44. *CHIMAERA* Linne, Syst. Nat. 10th ed., 1758, p. 236 (*monstrosa*).

- 44a. *C. OGILBYI*. GHOST SHARK. *Id.* Waite, Mem. Austr. Mus. iv. 1., 1899, p. 48, pl. 6. (Pl. xvii.).

Occasionally taken by the trawlers in moderate depths. Grows to about two feet in length exclusive of the caudal filament.

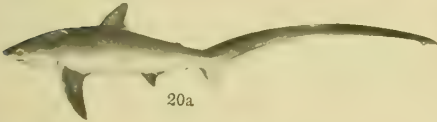




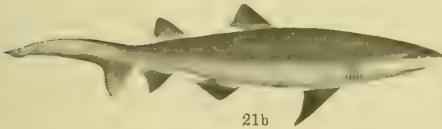
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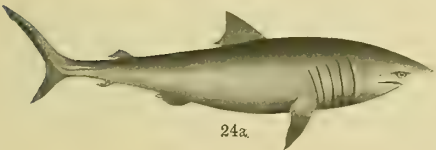
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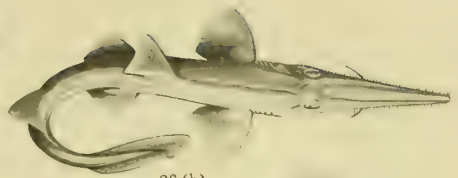
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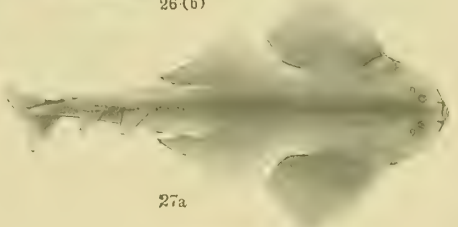
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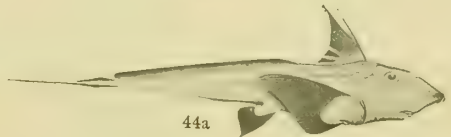
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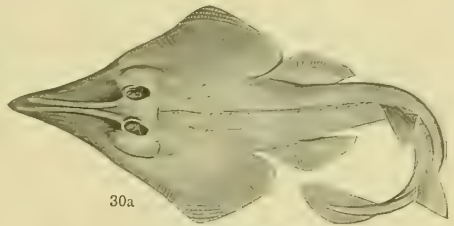
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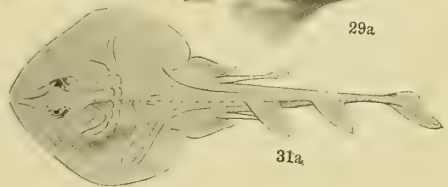
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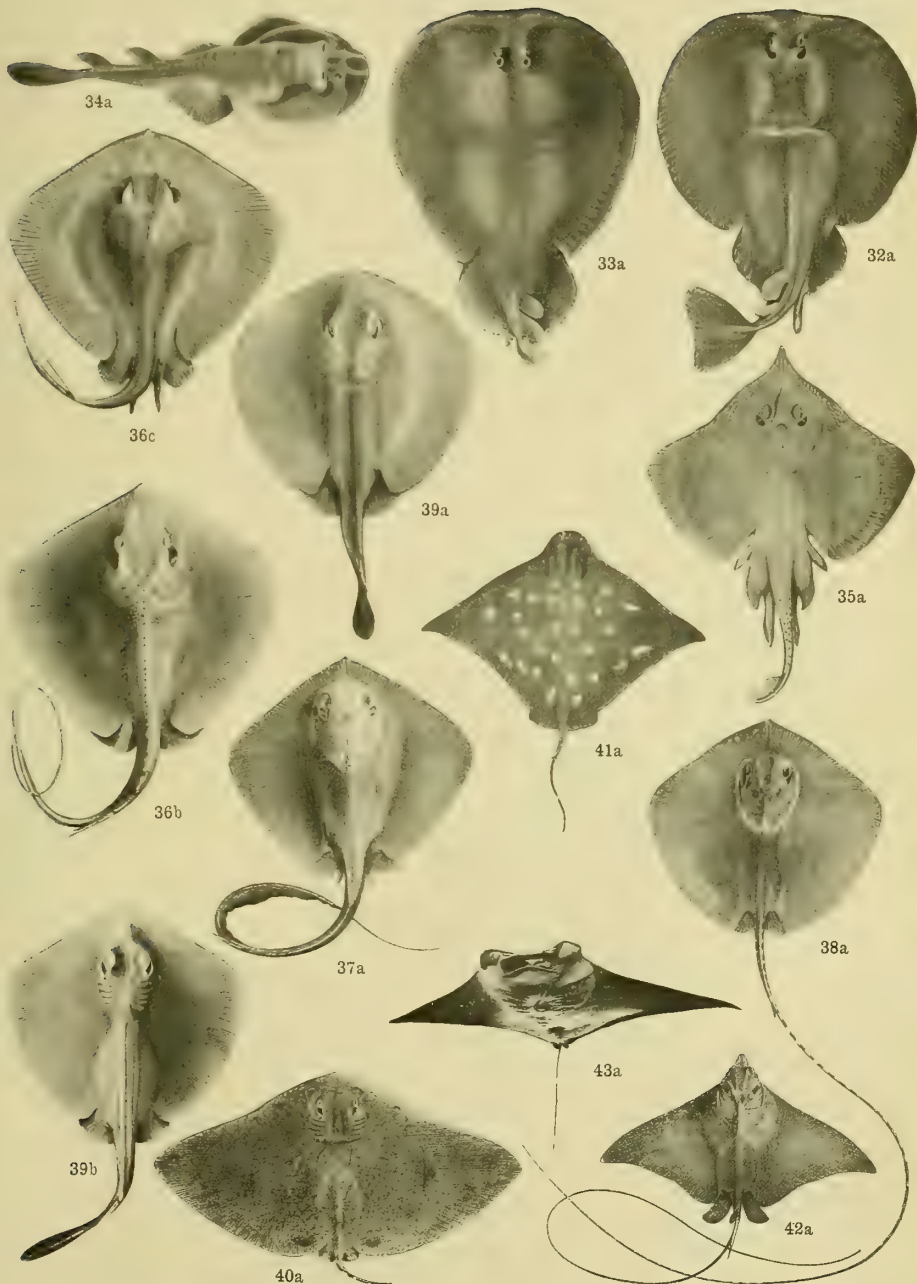
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CONTENTS OF PART I.

	Page
Report of the Council for 1913.....	1
The Mallophaga as a possible clue to Bird Phylogeny, by Launcelet Harrison, B.Sc.....	7
Bird Sanctuaries, by A. F. Basset Hull	13
A Monograph of the genus <i>Tistphone</i> , Hübner, by G. A. Waterhouse, B.Sc., B.E., F.E.S....	15
A new Victorian Araneiad, by W. J. Rainbow, F.E.S.	21
Notes on the Breeding-habits of the Purple-striped Gudgeon, <i>Krefftitus adpersus</i> , Castelnau, by Albert Gale.....	25
A new Australian Caprellid, by the Rev. Thomas R. R. Stebbing, M.A., F.R.S., F.L.S., F.Z.S...	27
Notes on some Australian Syngnathidæ, by A. R. McCulloch	29
Bird Notes from the North-west of New South Wales, by Walter W. Froggatt, F.L.S.....	33
An Interesting Exhibit, by A. S. Le Souef, Director, Zoological Gardens	35

CONTENTS OF PART II.

Report of the Council for 1914 ..	37
List of Members, 1914.....	41
Bird Notes, by Walter W. Froggatt, F.L.S.....	44
Two Beetles apparently new to Australia, by W. J. Rainbow, F.E.S.	46
The Migration of the Jolly-tail or Eel Gudgeon, <i>Galaxias attenuatus</i> , from the sea to fresh-water, by A. R. McCulloch	47
Further notes on the genus <i>Tistphone</i> , Hübner, by G. A. Waterhouse, B.Sc., B.E., F.E.S. ...	50

CONTENTS OF PART III.

Report of the Council for 1915.....	53
Some new Araneidae from the County of Cumberland, by W. J. Rainbow, F.E.S.....	58
Notes on Colour-variation of Opossums of the genus <i>Trichosurus</i> , by A. S. Le Souef, Director Zoological Gardens.....	62

CONTENTS OF PART IV.

Report of the Council for 1916.....	Front Pages
The Royal Zoological Society of New South Wales. Its present position and future aims, by A. F. Basset Hull, President ..	65
The Economics of <i>Trochus niloticus</i> , by Charles Hedley.....	69
The Destruction of Bird Life in Australia, by Walter W. Froggatt, F.L.S.....	75
The Lyre Bird: Some Nesting Notes, by John Ramsay and Albert E. Keene ..	81
Kangaroos in Captivity, by H. L. White.....	83
Illustrations of Australian Coleoptera, by A. Musgrave and E. H. Zeck.....	85
The deposition of the eggs of Monotremes, by Harry Burrell.....	87
Ichthyological notes, by Allan R. McCulloch.....	89
The Great Black Palm Cockatoo, <i>Microglossus aterrimus</i> , in captivity, by Dr. E. A. D'Ombrian M.R.A.O.U.....	95

CONTENTS OF PART V.

	Page
Taronga Zoological Park.....	99
Royal Zoological Society of New South Wales.....	100
The Distribution of <i>Anaspides</i> and <i>Ooperipatus</i> in Tasmania, by Professor T. Thomson Flynn ..	102
Birds in my Garden, by Henry L. White	103
The Birds of the Cobbora District, by Thomas P. Austin.....	109

CONTENTS OF PART VI.

Royal Zoological Society of New South Wales:	
Report of Annual Meeting.....	139
Balance Sheet.....	142
List of Members.....	143
Notes on some of the smaller Marsupials of the Genera <i>Phascogale</i> , <i>Sminthopsis</i> , <i>Acrobates</i> and <i>Dromicia</i> , by A. S. Le Souef, Director, Zoological Gardens, and Harry Burrell.....	147
Notes on records of Tree Kangaroos in Queensland, by T. Harvey Johnston, M.A., D.Sc., and C. D. Gillies, M.Sc., University of Queensland, Brisbane.....	153
Rescue Operations on the Murrumbidgee River, by H. K. Anderson, Inland Fisheries Officer ..	157
Notes on the Kelp Shell <i>Cantharidus irisodontes</i> , by Ernest Mawle.....	161
Notes on the Life History of an Emerald Moth, <i>Eucyclodes metaspila</i> , Walker, by E. H. Zeck ..	163
Studies in Phlebotomic Diptera, No. 1. New Species of Simuliidæ and Chironomidæ, by Frank H. Taylor, F.E.S.....	167
A Parasite, <i>Myxobolus hylae</i> , sp. nov., of the reproductive organs of the Golden Swamp Frog, <i>Hyla aurea</i> , by T. Harvey Johnston, M.A., D.Sc., and M. J. Bancroft, B.Sc.....	171
Ornithological Notes, edited by A. F. Basset Hull.....	177
The Flight of a Falcon, by Thomas P. Austin	185
The Birds and Animals Protection Act, 1918.....	188
The Crow Family, by Walter W. Froggatt, F.L.S.....	189

CONTENTS OF PART VII.

Royal Zoological Society of New South Wales:	
Report of Annual Meeting.....	197
Balance Sheet.....	200
List of New Members.....	201
About Hands, by Charles Hedley.....	203
The Australian Museum—Notice only.....	204
Swarming of the Soldier Beetle, <i>Telephorus pulchellus</i> , by E. H. Zeck.....	205
Notes on the Plumage-display of the Birds of Paradise in Taronga Park, by A. S. Le Souef ..	206
A simple method of preparing Crania, by Heber A. Longman.....	208
Aviary Notes on the Pectoral Rail, <i>Hypotaenidia philippensis</i> , L., by T. C. Marshall.....	208
The Spine-tailed Swift, <i>Chaetura caudacuta</i> , by H. E. Finckh	210
Life History of the Fish, <i>Galaxias attenuatus</i> , by W. J. Phillipps	211
Notes on the Mouth-parts of Lice, by Launcelot Harrison, B.Sc., B.A.	214
Check list of the Fish and Fish-like Animals of New South Wales, Part I., by Allan R. McCulloch.....	217

THE AUSTRALIAN ZOOLOGIST

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Lecturer and Demonstrator in Zoology at the University of Sydney.

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CONTENTS OF PART VIII. (Price, 4/.)

	Page.
Royal Zoological Society of New South Wales	229
Field Notes on the Life History of Monotremes—I, by Harry Burrell	231
Notes on the Habits and Reproduction of the Great Western Burrowing Frog, by Prof. W. J. Dakin, D.Sc., F.L.S., F.Z.S.	241
Myrmecophilous Coleoptera, by E. H. Zeck	245
On a New Species of <i>Lophopodella</i> , by Rex W. Bretnall	248
Notes on the Breeding of the Scrub Turkey, by A. S. Le Souef	251
The Wedge-tailed Eagle, by Walter W. Froggatt, F.L.S.	252
Nature Notes	255
Title-page, Vol. 1.	i.
Contents of Vol. 1	ii.
Index	i.

Royal Zoological Society of New South Wales.

NEW MEMBERS.—The following new members have been elected since the publication of the list in Part 7 of this journal:—

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- | | |
|---|--|
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| CURTIS, HARRY P., Crown Solicitor's Office, Sydney. | MITCHELL, MARK, A.M.P. Buildings, 89 Pitt Street, Sydney. |
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| DIXSON, THOMAS STORIE, M.D., 215 Macquarie Street, Sydney. | MUSGRAVE, ANTHONY, Australian Museum, Sydney. |
| FERGUSON, DR. EUSTACE WILLIAM, Department of Public Health, Sydney. | NEWTON, HUBERT, Bank of N.S.W., William Street, Sydney. |
| GILDER, ARCHIBALD E. B., "Woodelms," Cross Street, Mosman. | PARADICE, WILLIAM E. J., "Arden," Victoria Avenue, Chatswood. |
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| HARRISON, LAUNCELOT, B.Sc., B.A., Department of Zoology, The University, Sydney. | TAYLOR, AUGUSTUS SELWYN, "Beth-fay," Margate Street, Kogarah. |
| KERRY, CHARLES HENRY, Challis House, Martin Place, Sydney. | THOMPSON, ALFRED WEBSTER, "Wid-den," Bradley's Head Road, Mosman. |
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| KING, PERCY WHITELEY, David Street, Clifton Gardens. | TUTHILL, ARCH. C., 143 Phillip Street, Sydney. |
| KINGHORN, ROY J., Australian Museum, Sydney. | VAN SOMEREN, Mrs. G. A., "Bracon-fel," Mosman. |

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| COUSINS, W. G., c/o Angus & Robert-son, Ltd., Castlereagh Street, Syd-ney. | THE LIBRARIAN, Turnbull Library, Wel-lington, New Zealand. |
| EDWARDS, HENRY VASSAL, Tathra Road, Bega. | WISE, MISS MARY I., Foster Street, Sale, Victoria. |

The vacancy in the Council caused by the death of Mr. W. J. Rainbow was filled by the election of Mr. Launcelot Harrison, B.Sc., B.A., of the Department of Zoology, The University, Sydney.

Mr. A. R. McCulloch, Honorary Editor of this journal since its inception, has relinquished the position owing to pressure of other duties. Mr. Launcelot Harrison, B.Sc., B.A. has been elected in his place.

Mr. A. F. Basset Hull has been elected President of the Royal Australasian Ornithologists' Union for the second year in succession. He has also been elected a Corresponding Fellow of the American Ornithologists' Union.

Sir George Kenrick, ex-Lord Mayor of Birmingham, a keen collector of Butterflies, recently paid a visit to Sydney. He expressed a wish to obtain a collection of Australian Butterflies, and consulted Mr. G. A. Waterhouse, Honorary Treasurer of this Society, who, in conjunction with Mr. George Lyell, of Gisborne, Victoria, and Mr. G. M. Goldfinch, of Sydney, agreed to make up a representative collection provided that Sir George Kenrick made a contribution to the Society's Handbook Publication Fund. To this Sir George agreed, and fixed the contribution at £150. Mr. Lyell has been elected an Honorary Member of the Society in recognition of his action, and the thanks of the Society are due to Messrs. Waterhouse and Goldfinch for their share in thus enriching the fund.

Additional donations to the Handbook Publication Fund, received since publication of the list in the last number of this journal, are:—Hugh Dixon, Esq., £5; G. J. Cohen, Esq., £5, and A. E. Jaques, Esq., £3/19/.

The Fund now stands at £264/19/.

Dr. J. Burton Cleland, Microbiologist of the Department of Public Health, Sydney, and a member of this Society, has been appointed Professor of Pathology in the University of Adelaide.

Dr. R. J. Tillyard, a Member of the Council of this Society, has accepted the appointment of Biologist to the Cawthron Institute, Nelson, New Zealand. He will proceed to England and America, representing New Zealand at the Conference of Entomologists to be held in London in June. It is most gratifying that the scientific attainments of Dr. Tillyard have been so signally recognised by the Dominion, and it is equally a matter for regret that our own State has not been able to offer Dr. Tillyard a position and remuneration commensurate with his undoubted abilities.

By the death of Messrs. W. J. Green and W. J. Rainbow, the Society has lost two of its oldest members. Mr. Green was first elected to the Council in 1905, and held the office of Honorary Treasurer until 1916. On his retirement from this office and the Council, he was elected an Honorary Member in recognition of his valuable services. He died on the 13th March last. Mr. Rainbow was elected to the Council in 1910, and held office up to the date of his death, which took place on 21st November last.

Mr. Charles Hedley has been appointed Acting Curator of the Australian Museum in succession to the late Mr. Robert Etheridge, Jr.

FIELD NOTES ON THE LIFE HISTORY OF MONOTREMES.—I.

By Harry Burrell.

(With 6 Figures in the text.)

On September 25th, 1919, I went to Manilla, New South Wales, for the purpose of collecting the eggs and young of Monotremes. According to "The Oldest Resident," the district was then experiencing the most severe drought since that of 1862, but as a "Spring" drought is a somewhat unusual condition, I considered that it would be interesting to carry on my investigations despite the difficulties, and to record my observations so that they might be compared with those made in more normal times.

It so happened that my aims coincided with those of Mr. Charles M. Hoy, Collector for the Smithsonian Institution, and as he was able to fit his plans in with mine, I had the advantage of his help and company during three weeks we spent together in the district.

THE ECHIDNA.

Within five hours of my arrival at Manilla, I was fortunate enough to secure a female Echidna with a young one in her pouch. This was $2\frac{3}{4}$ inches long from the end of the muzzle to the end of the tail when fully extended in its natural crawling position, and it was 1 inch wide. Its body was of a cold flesh colour, and its head bright pink. The toes were dull black with light brown nails, while its egg-chipping apparatus and the area around the nostrils were bluish black. Its eyes were not open, and the ears also were apparently closed. The top portion of the muzzle showed a mass of bright red arteries, and many others were on the throat connecting with the abdomen and running under the arms to the abdomen. Its back was very smooth, and had a distinct fine line extending from the nape to the tail, but there was neither fur nor quills. Its neck, shoulders, and the sides of the fore-parts were wrinkled or "goose-fleshed," and there was a perfect indentation representing the pouch. No trace of the spurs was visible to the naked eye, and its excreta resembled yellow curdled milk.

When I first examined the mother's pouch, this baby was found snugly attached to the parent's abdomen, its head pointing in the same direction as hers. But after having detached it; I noticed that it always re-entered her pouch with its head pointing towards her tail, and blindly groped its way by grasping handfuls of her fur in and around the pouch, while occasionally protruding its tongue. After a while the mother's fur became moist and tangled, and it curled into loops through which the young forced its way head first until it became so enmeshed that it took some time to remove it from the pouch again without causing either injury or pain to it or its mother. I did not hear the young Echidna utter any sound during these little experiments, but the mother gave a mild dog-like sniff occasionally.

The young of both the Echidna and the platypus maintain a sort of perpetual motion with their fore-arms, first one being thrown out and then the other. The limb is methodically extended to its full reach with the palm widely spread, and then with an inward grasping sweep is brought in to the breast, the palm being simultaneously closed. One young Echidna which I held on its back in the palm of my hand actually scratched itself sufficiently to draw blood by this vigorous action of its arms. These movements were so persistent in the young specimen described above that I was unable to satisfactorily photograph it alive, and I had to be content with the accompanying snapshot (Fig. 1). I believe the perpetual movements of the fore-limbs of the young of both the Echidna and the platypus assist the flow of milk from the mother's milk-glands to the outer surface of the skin, while they also enable the young to regain a hold upon their parents after they have been detached.



FIG. 1—Young Echidna from pouch. H. BURRELL, PHOTO.

The accompanying photograph of a female Echidna (Fig. 2) lying upon its back is intended to illustrate what I have suggested in an earlier part of this volume (p. 87), as to the possibility of the animal depositing its egg directly into its pouch, though I have nothing further to add to my first note upon the subject.

The Manilla District is usually infested with rabbits, but in consequence of the drought it was temporarily free from these pests at the time of my visit. The rabbit undoubtedly interferes with the haunts of both the Echidna and the platypus, though these animals undoubtedly suffer still more at the hands of the

rabbit-trappers. Although the traps are cunningly camouflaged by being buried in the soil, they are often discovered by the Echidna, which appears to mistake the disturbed earth around them for the work of some burrowing insect. They are consequently found gripped in the jaws of the trap by the trappers on their morning rounds, and I was informed by one man that he had caught the same Echidna on three separate occasions in the one trap. Fortunately, most of the trappers release the animal, its skin being of no commercial value, but though their limbs are seldom broken by the traps (possibly their sluggish movements cause them to struggle less than other animals) I believe a large percentage of the crippled beasts crawl back to their lairs among the boulders, where they die as a result of blood-poisoning. This belief is supported by the evidence of bleached bones and quills unearthed by rabbits at the mouths of Echidna's natural rooks. It would appear that the rabbits readily occupy such strongholds so soon



FIG. 2.—Female Echidna. H. BURRELL, PHOTO.

as they find that the former tenant has ceased to raise its spines. The staple food of the Echidna consists of Ants, principally the Sugar Ant (*Camponotus nigriceps*); the mound-building meat ant appears to me to be only secondary in diet.

In the excrement of the Echidna I have found as many as fourteen undigested heads of larvae, probably of a beetle of the Family Scarabæidae; and several pieces of gravel, ranging in size from a match-head to the size of a split pea, in the one stool. I have found on removing the young from the Echidna's pouch, that the pouch was filled with a pale amber coloured fluid; it was so full that when the lips of the pouch were pressed together it oozed out. I estimated the quantity to be from two to three ounces. I thought at the time that the fluid

must have been urine, but I am not sure now that the *Echidna* does exude urine; I have never witnessed the action in the many specimens I have handled.

LINKS IN THE LIFE HISTORY OF THE PLATYPUS.

The observations noted in this paper were made principally during the most severe "Spring" drought recorded in the North-western portion of New South Wales. The deductions submitted may therefore have to be modified should further investigations be carried out during a bountiful season.

Platypus usually select a quiet part of the river for breeding purposes, which need not necessarily be a deep or long pool such as they are usually found in at other times of the year in search of food and freedom. In the Manilla District, an ideal natural nesting site is a shaded pool with steep sloping banks of suitable soil, preferably black or red, which is reinforced with the roots of River-Oak trees (*Casuarina*), and margined with reeds. Female platypus appear to shun one another during the breeding season, since only once have I discovered two occupied breeding burrows opening into the same pool. Even in that instance, the burrows were separated by a distance of fully a quarter of a mile, and

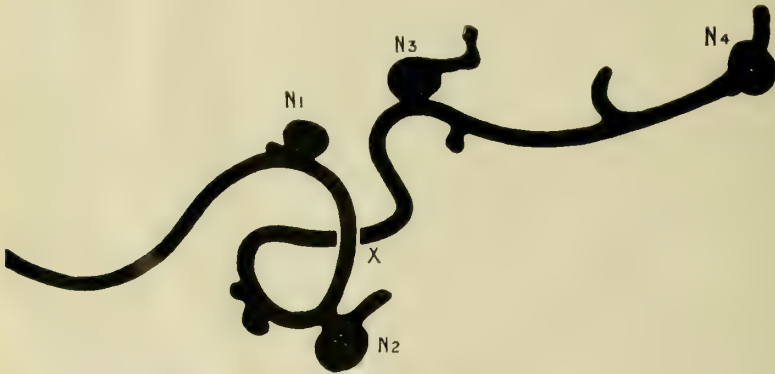


FIG. 3.—Plan of platypus burrow containing four nests, N1, N2, N3, N4. At X, the burrow passes a foot below its earlier level.

they were placed in opposite banks of the river. Higher up the river, where both male and female platypus were comparatively plentiful, we systematically searched both sides of the river for a distance of eight miles, but failed to find one inhabited burrow. We waded the whole distance, and searched the banks from below the water level to the tops above, and although we cut out the tunnel of several entrances that we discovered, including those of Water Rats (*Hydromys*), all proved to be ancient and dilapidated, and the contained remnants of nesting material appeared as though they had been submerged, being just a musty, sodden mass, embedded in silt or "platypus pug."

Although platypus prefer soft soil to burrow into, I once found a burrow where three inches of river shingle had been removed from the face of the bank at the entrance before the soft soil was reached. This stratum of shingle had evidently once been the temporary bed of the river.

A point I have been unable to determine is whether a platypus occupies the same burrow for more than one season. With the exception of one extraordinary case described below, I have never observed more than one nest in any burrow. I

have at times found what I consider to be litter here and there in the subway, but never actual nests. It would apparently be a simple matter for these animals to scratch out an old nest, and replace it with new material, but this is evidently not done. The exception referred to contained no less than four nests in different positions (Fig. 3), three of which were in various stages of dilapidation, while the fourth, though scanty in material, contained twins. Mr. Hoy examined these four nests with me, and agreed that they bore the appearance of having been built at different periods, probably at yearly intervals. The bank in which this burrow was placed was unusually faulty for the purpose, having a sandy subsoil. It was on a beautiful stretch of water about three miles below the New England water-falls, where the river is actually bridged in places by rocks, so that when the water is at a low level, as in periods of drought, the river becomes



FIG. 4.—A typical platypus haunt on the Manilla River at Manilla. H. BURRELL, PHOTO.

a chain of ponds which prevent the platypus from travelling far. Possibly, therefore, the animal or animals which successively inhabited the four nests had become river-locked, so to speak, and were compelled to make shift in the only available faulty quarters. We dug out three other unoccupied burrows in the same bank, each of which had evidently been abandoned on account of the surface sand collapsing while the nesting chamber was being excavated. The platypus was perhaps compelled to shift along the bank until it chanced to find the old burrow in the only part which could be used for the purpose, and it made itself content by burrowing on past the vacant nests. Though I have found adult males in those temporary burrows which are used for resting purposes only, I have never observed one in any of the breeding-burrows I have examined; the female has been their only adult inhabitant, while even she is not always at home with

her young during the daytime. On two occasions I have unearthed nests which contained the mother and one young one, and once a female at home in a fully-constructed, new nest without eggs or young. But on three occasions when I have found twins, and once when triplets were discovered, neither the mothers nor the fathers were on the premises. I have observed that platypus may be seen feeding in the river at almost any time during the day, so I have come to the conclusion that if the mother has more than one young one to supply food for, she is compelled to feed during the daytime to create a sufficient milk supply. I think it probable that the male platypus does not assist in providing the young with food, but that the female, like the mother *Echidna*, gets along without his assistance after copulation.

Nevertheless, I should mention here that a full-blooded aboriginal voluntarily informed me that he had seen a male platypus carrying nesting material across a river and into a burrow. He said that it had two bundles which were gripped by the spurs, one on either side of the tail. Though this would appear improbable, it is nevertheless possible, because a platypus trails its hind-legs inertly behind with the tail when swimming quietly. Further, there is nothing to prevent a male platypus from climbing a bank with its spurs so loaded, since they are not rigid like those of a cock, but could be used almost as a thumb, though bent somewhat in the opposite direction. It might therefore be possible for the animal to collect nesting material from the ground by lifting it up with the curved spur, and then clamping it to the thigh.

But whatever be the means by which nesting material is carried to the nest, I think it probable that the jaws and horny grinders of the platypus are brought into play. One nest I examined was composed principally of sections of the bases of reeds which had been flattened, and which looked exactly like shredded or fuzzed bark. I examined the reeds growing on the bank near by, and also some pieces which were strewn about, but found that even their dead and decayed portions retained their natural rounded shape. I therefore suppose that the flatness of the reeds in the nest is caused by the animal's grinders. Though I have examined over one hundred burrows of *Ornithorhynchus* during the past ten years, I have not found two quite alike. They vary in their length, direction and shape, their depth and their entrances, the pug-pits and nesting cavities, and the quantity of pug used. The accompanying photograph (Fig. 5) illustrates a model of a burrow which is true to scale, while I also submit diagrams of other curious burrows selected from my notes to depict the shapes of different tunnels.

The length of the burrows ranges from fourteen to fifty feet. They wend either to the right or to the left, or both ways, and sometimes actually curve around into a complete loop, one portion winding at least twelve inches below the other. I think the platypus must know when it is approaching its own or any other burrow by some sense of sound, which causes it to divert its course so as to avoid the tunnel by a space of twelve inches or more. One burrow which I opened up circled round on a uniform level and terminated when it came within a foot of itself. I have found another platypus burrow descending to a depth of four feet in order to avoid a rabbit burrow, and then rising again to its original level on the other side. I have also examined burrows which extended within twelve inches of some other animal's burrow, and then either turned back in the opposite direction or to the right or left of the "sounded" obstacle.

The entrance to a platypus breeding burrow is arched above and flat below, and its size varies from four to six inches in width, and three to four inches in height. This is, I think, in accordance with the size and shape of the individual



FIG. 5.—Model of a platypus burrow, showing entrances above and below water, four puggits, false nest on right and occupied nest on left. H. BURRELL, PHOTO.

making the excavation, which is apparently the female platypus only, since such small-sized apertures would doubtless prove tight fits for full-grown males. The size and shape of the tunnel is usually in keeping with that of the occupant in a normal crawling position, but there is some slight variation of the measurements throughout the tunnel.

The nest-cavity also varies in size and shape. One which I measured was almost perfectly round, and a stick nine inches long could be just moved about in it in every direction. Other cavities I examined were much larger and differently shaped; they were usually oval and always wider than high, and measured about twelve by eleven inches. The blind ends leading off from the main tunnel, or "Pug Pits" as I call them, are apparently merely cavities from which the female platypus has scratched out the soil with which to pug her burrow; they may also accommodate some of the soil again when she removes it as she passes to and fro along the burrow. There is always a section of pug close to the entrance to the

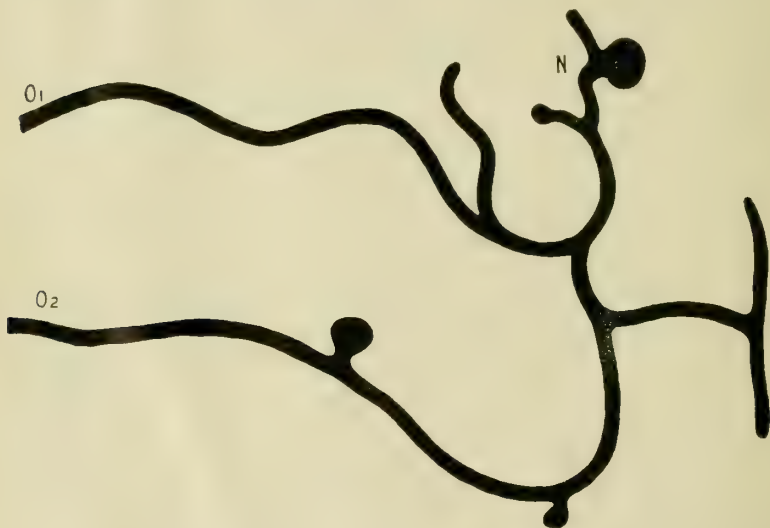


FIG. 6.—Platypus burrow fifty feet in total length; N, nest; O₁, O₂, entrances.

nesting-chamber, and one finds what appears to be a second cavity or blind off-set from the nesting cavity proper. This is evidently only a pug-pit, though it may also provide the mother platypus with room to turn in without unnecessarily disturbing her young ones, or to rest in. The other pug-pits may possibly serve to enable the young platypus to pass each other should they meet within the subway, or to allow the mother to turn comfortably within the narrow tunnel. They may even serve as get-aways from enemy invaders, though I have observed that a nesting female does not desert her nest until the final plugged partition near the nest itself is broken through. And since it has taken at least an hour to unearth some of the nests we have investigated, it would seem that the females within them must have had ample time to leave their nests and avail themselves of these cavities had they so desired. I therefore believe my first suggestion accounting for the presence of these cavities to be the most reasonable.

"Puff-Pug" is found in the breeding burrows only, so far as I have observed, and not in the shorter resting burrows of the adults. There are usually three lots of pug in a tunnel, which are usually placed where there are turns, but always close to a pug-pit. Some burrows contain only two pugs, while others have four. The pugs may be six to twelve inches thick, though this measurement is very indefinite owing to the variability of the burrows and their fittings. Further, all the nests I have examined have been imbedded in this pug, and one which I investigated particularly had three inches of pug below it in the nest-cavity.

The platypus evidently removes the pugs as she leaves or enters the nests. I have taken a female from a newly-made and complete nest which was pugged in three separate places. Similarly other females which were each nursing a young one in their nests were tightly pugged in, while the burrows leading to several nests in which I found sets of twins and triplets without their mothers, were likewise pugged up.

The constant removal and working of the soil of which the pugs are built makes it so soft and fine that it sometimes becomes quite velvety to the touch, and clings like flour if squeezed in the hand. It is always slightly damp after being worked up by the platypus, but in the nest containing triplets without their mother, the pug near the nest had dried and shrunk away from the sides of the tunnel so much that I was able to move it in a mass, though it fell to powder in my hands when slightly squeezed. It gave me the impression that the mother must have been quite a considerable period away from the nest.

The hair on the tail of the female platypus is inclined to be dishevelled at all times, and there is frequently a bald patch on the upper surface. I have seen several specimens, including two during the 1919 season, in which the hair was worn away from an area about an inch in diameter, situated about one and a-half inches from the tip of the tail. I suggest that this is due to friction or heat resulting from the coiled-up position of the animal when she is sitting on her rump on the damp and decaying vegetation of the nest, when she is either hatching her eggs or nursing her young in their earlier stages.

Again, it is possible that the females make use of the tail when constructing the pugs which block up their breeding burrows. These pugs might be made either with the animal's paws or with the head rather than with the tail. In the former case, however, one would expect to find impressions of the knuckles on the face of the pug—the web of the hands being always protected when the platypus is walking, climbing, or burrowing by being tucked away in the palm; but I have failed to find any such imprints. If, on the other hand, the head is used, it would seem that the sensitive membrane of the bill must come into unpleasant contact with the hard earth forming the bottom of the tunnel, while the eyes and nostrils would be subject to irritation arising from the fine loose pug-earth.

The tail may also serve to clear the earth from the tunnel when the platypus is digging the burrow. The female certainly scratches away the soil with her front paws, and throws it under her body, and it is then perhaps pressed away behind her with a flick of her trowel-like tail. It may be that she scratches ahead for some distance, and then brushes or flicks the earth behind her as she backs out of the tunnel. The tail can be readily bent or coiled into such a position as is necessary to carry out this operation, particularly that portion of it which would be required if it be so used. It would appear that the female must utilise the tail in some such manner, since she could scarcely turn within the burrow, which is only of about the same dimensions as her own body, and she rarely makes a

recess until she has burrowed for a distance of at least several, and sometimes as much as twelve feet.

I examined two females during the 1919 season, however, one in milk and the other barren, in which the hair was not unusually worn; but this fact does not disprove the suggestion offered above.

It would appear that a platypus may be compelled to dig out several burrows before she constructs one which is not faulty; and it may be that she must dig far into a bank before she becomes aware of faulty soil above the nesting chamber, which is usually that part of the burrow situated nearest the surface of the earth. The burrows vary from fourteen to fifty feet in length, and they may be tunnelled into soft soil, or into that which is dry, caked, and gritty as a result of drought conditions. So that some females may have much more burrowing to do than others, which would account for the differences noted in the amount of hair worn from their tails. Platypus do not occupy the breeding burrows after the young are capable of fending for themselves, but move into other burrows which are situated near pools where food is abundant. These are usually in the form of semicircular tunnels, and contain from one to three sleeping recesses; they may run for a distance of seventeen feet back in to the bank. They generally open under ledges formed where the river has washed away the soil from the roots of trees. When the river is low, these openings are above the water, but secondary openings leading to the burrows may be found here and there higher up on the bank or even behind the trees, which, I believe, are used by the animals either as exits or air-holes when the river rises above the openings below the ledges. I have never found either pug or nesting material in these temporary burrows.

On December 23rd, 1914, I visited the Manilla River at Caermathen, and while searching along the bank for platypus tracks, accidentally put my foot through the soft earth into a burrow. As the soil near my legs suddenly heaved I grabbed at the hidden object moving beneath it, and secured an adult male platypus which was trying to force his way past me. I then broke the tunnel open towards the bank, and secured a second adult male which was coiled up in a ball and half asleep in a cavity. This tunnel was apparently "Bachelor's quarters." It may be mentioned here, that on January 25th, 1910, I trapped two adult large male platypus together in a turret trap in the Namoi River, at Manilla. The trap had been set only one and a-half hours between six and eight o'clock in the morning, and I believe the two were travelling together in search of food. This fact, together with the discovery of two males in the resting burrow, shows that the males enjoy one another's company at some periods of the year.

NOTES ON THE HABITS AND REPRODUCTION OF THE GREAT
WESTERN BURROWING FROG, *HELEIOPORUS ALBOPUNCTATUS*.

BY WILLIAM J. DAKIN, D.SC., F.L.S., F.Z.S.,

Professor of Biology in the University of Western Australia.

(With a Figure in the text.)

During the month of April certain small areas in South Perth came to be the practising grounds for orchestras of frogs, the noise in some cases being sufficient to prevent people sleeping at night. A search by the unhappy citizens for the disturbers of the peace often proved fruitless, and this was all the more strange seeing that the noise was in these cases usually produced quite close to a house. The author was one of the worst sufferers, but traced the origin of the curious croaking at an early date. The noise is peculiar, and hence rather difficult to describe. It is somewhat between a little coo and a moan, not a sharp cry, or a plonk, but a prolonged and very mournful croon. The croaking was first heard from a low-lying part of the garden which was quite bare of vegetation, owing to the fact that the ground had been dug over and trampled whilst building an extra room to the house. (We have been told that it was originally quite swampy.) The weather was still dry—the fag end of summer—and consequently it seemed unlikely that the owners of the voices could have arrived from any other garden. At first only one or two frogs were present, and they commenced regularly about six o'clock in the afternoon, and stopped somewhere about five o'clock in the morning.

Every night following the first appearance the number of croakers increased, until in two or three weeks' time the noise from the 40 square feet of garden was something appalling. If one went out at night to investigate with a lantern, not a sign of a frog could be observed anywhere. To make matters more annoying, the noise stopped even if one walked as softly as possible to any spot where one could have sworn to the presence of a frog.

It was, of course, obvious that the croaking frogs were all below the ground, and that they had either merely awakened from their summer's sleep, or had at the same time risen from greater depths in the soil where moisture would have been present throughout the long dry season. The use of a spade soon brought the hidden animals to light. They were situated about 18 inches to 2 feet below the surface of the light sandy soil. Four were obtained in two square feet. and it was calculated that if the distribution was anything like uniform there must have been 100 frogs in the small 50-ft. square area near the house. The frog turned out to be *Heleioporus albopunctatus*—the Great Western Burrowing Frog. It is said to be represented in the East by *Philocryphus*, and in this connection there are two features to be noted which are curious similarities. On being handled, especially if the back be gently tapped, the frog becomes gradually distended, swelling up until the skin looks as if it would burst. This is effected by pumping air into the lungs, which seem capable of enormous distension. A

distended specimen was killed in such a way that most of the air was retained—the lungs were found to reach almost to the posterior end of the body cavity. The other common peculiarity of the frog is that when stroked or tapped in order to produce the swollen state the animal often utters the most extraordinary cries. They can be described exactly by the words used in reference to *Philocryptus flavoguttatus* (the Eastern Burrowing Frog) in Lucas and Le Souef's Animals of Australia:—"and sometimes on such occasions it cries in the weirdest fashion just like an infant."

The first peculiarity mentioned above seems, as suggested by Fletcher, to be common to very many burrowing frogs.

A few weeks after the animals first notified their existence, a number of small holes about the diameter of a penny were to be seen on the surface of the ground. If these were followed down, each led to a little chamber in which a frog was sitting. Evidently the animals came to the surface at night. They were always about 18 inches below the surface in the day. The excavation never went down vertically from the opening, but took an irregular course, with quite a gentle slope, so that, measured along the burrow, each frog was three feet or more from the surface aperture.

There is something of interest in the peculiar rhythm of the croakers. As a rule not a sound was heard before 4.30 p.m., and the orchestra ceased about 4.30 to 5 a.m. Now this rhythm was set up *before* the frogs connected their underground caves with the surface. What determined the rhythm, and the hour of starting and ceasing? Day and night could not have been appreciable, and the sun was still shining strongly when the evening chorus began. It seems doubtful whether temperature changes would have provided stimulus sufficient at the time when the frogs started, especially when the depth below ground is noted.

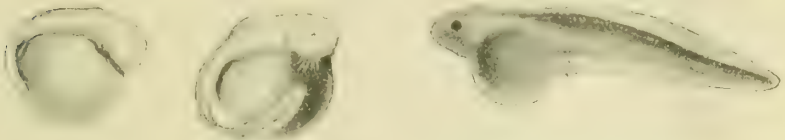
Diurnal rhythm is not an uncommon feature in animal and plant life, and, once set up, it is sometimes possible for it to continue without the continuance of the stimulus. Thus the marine Protozoan *Noctiluca*, when taken into a dark room, will only give forth phosphorescent displays by night, although there is no light whatever in the room during the whole 24 hours. The little *Oxalis* also performs its sleep movements regularly at sundown and sunrise, even if removed to a dark room. No satisfactory explanations of the above are yet forthcoming. Perhaps the croaking habit of frogs is a feature of a similar kind.

In making excavations in order to obtain frogs, the author discovered, much to his surprise, that eggs had been laid underground in places where there was no sign of water. Every two or three feet apart, and at depths of about 18 inches below the surface of the soil were small chambers about 3 inches in diameter. They appeared to have no passages leading to or from them. Each chamber was filled with a mass of eggs enclosed in, and separated by, a mass of frothy mucus. The most noteworthy feature was the regularity of this method of deposition. No traces of eggs were found in any other places, and there was no more tendency apparently to deposit them near a pool of water than at a distance from it. The soil remained for weeks after this first discovery of the eggs in exactly the same condition—i.e., light sandy soil containing organic matter and in a moderately dry condition. It ran easily through the fingers, and rain percolated through it rapidly, showing no tendency to collect on the surface.

The eggs numbered 50-100 in each mass. They were somewhat large and without pigment. In order to trace the general features of development, small quantities of spawn were placed in little caverns made by the author in soil, the whole being contained in a large dish. To get still nearer the normal conditions,

a depression was dug in the ground and the eggs placed in a little hollowed-out space about the size of a man's fist. This was covered over with soil to a depth of about 1 foot, but a sheet of glass formed one side of the nest. The eggs could be seen therefore without disturbing them in the slightest. After three or four days embryos were well advanced, and external gills could be observed. There was, however, no sign of hatching. During the following days the external gills were further developed, and then replaced in the usual manner by internal gills. The embryos grew steadily, remaining coiled round the yolk sac on the surface of which blood vessels were very distinctly visible.

About three to four weeks after the laying of the eggs, a few of the embryos were placed in a dish and fresh water added. They hatched out in a few minutes. These specimens were kept for a month longer, during which time they gradually developed. The other collections of embryos, including those in the garden observation nest, were, however, still unhatched. The yolk sac had completely disappeared, external gills had vanished, and the operculum had grown completely over the gill slits. The embryos were pigmented and well advanced.



Three stages in the development of *Heleioporus albopunctatus*. The figure on the right represents the stage at which hatching took place.

Further development became slow, and practically no further external changes were to be seen at the age of six or seven weeks—probably two months in some cases, when a tragic occurrence (from the point of view of the Amphibia) put a complete end to the experiments. During the whole period (from the first trial at the end of three weeks until the end of the seventh week) the addition of water to any embryos caused them to hatch at once. In some cases the water was removed afterwards and the tadpoles allowed to lie in the moist sand. They lived covered with soil for two or three days. It was not possible owing to other business to experiment carefully with them, and they dried up. It would be interesting to know how long the hatched tadpoles could live in a moist atmosphere without actual water, provided that moulds, etc., did not develop.

Thus in the early stages of the life history of the West Australian Burrowing Frog we have an example of a large heavily-yolked egg with an embryonic development which may progress to a rather advanced stage without hatching. So far as is known at present, there is no tendency to go beyond a stage in which legs are not visible externally. Hatching had not taken place at the end of seven weeks, and probably a longer period than this had elapsed in the case of some undisturbed examples. The retention of the larva within the egg membrane is evidently controlled by the presence or absence of water.

There is perhaps some reason for mentioning the occurrence that put an end to all the experiments. My house is situated very close to the Swan River. One Sunday a heavy gale arose from the south-west, and at the same time an unusually high tide occurred. The combination resulted in a rapid rise in the river until waves commenced to break over on the lawn. At about 10 a.m. the bare area where the frogs lived was being flooded. The water was only brackish. At

10.30 a.m. the water was swarming with tadpoles of the same advanced stage as those from my experimental nests. Evidently the water had acted as the awaited stimulus on the multitudes of unhatched tadpoles below the ground. The effect was startling. Unfortunately the water was too salt. At 11.15 most of the tadpoles were already dead, and a little later all had succumbed. The water subsided during the afternoon, but the immersion had killed off all the adults and not a single croak has been heard from the garden since. My experimental nests shared in the tragedy. Perhaps next year we may take steps to find out the longest possible time the tadpoles can be kept without hatching, and what stage can be reached by them.

Comparison with Eastern Species. So far as I know, the development of our *Heleioporus* is somewhat different from that of the Great Eastern Burrowing Frog, *Philocryphus flavoguttatus*, although the embryo of this species is said to acquire external gills before hatching.

There is, however, some resemblance to the conditions described by Fletcher as characteristic of *Pseudophryne australis* and *P. Bibronii*, species of Bufonidae, except in so far as deposition of spawn is concerned.

In these species, if the ova do not get into water the hatching is postponed until they do. This period, according to Fletcher, may be as much as three or four months. In this case, too, there seemed no indication of the metamorphoses being completed, even when hatching had been very much delayed.

Fletcher states that the eggs of *Pseudophryne* are deposited after rains "in depressions or cavities, preferably under stones, but when these are wanting, under pieces of old tin, etc." The same author remarks that one pole of the egg is pigmented black and there are no signs of external gills at any stage. These are obvious differences from the stages in the Western Burrowing Frog, which is now shown for the first time to be capable of a prolonged embryonic sojourn as a tadpole within the egg membranes.

References:--J. J. Fletcher, Oviposition and Habits of Certain Batrachians. *Proc. Linn. Soc. N.S.W.*, Vol. 4 (1889), pub. 1890.

MYRMECOPHILOUS COLEOPTERA.

BY E. H. ZECK.

(Plate xix.)

Amongst the many interesting and remarkable Families of the Order Coleoptera, found in association with ants, are the Ptinidae and Colydiidae.

Illustrated on the accompanying plate are four species, of different genera, of the Family Ptinidae, and one species of the recently made genus, *Euclarkia*, of the Family Colydiidae.

These figures have in each case been drawn from specimens which were kindly forwarded me by Mr. J. S. Clark, who is an enthusiastic collector amongst ants' nests in Western Australia.

FAMILY PTINIDAE.

Genus *Diphobia*, Olliff.

D. longicornis Lea. *Trans. Roy. Soc. South Aust.*, xliii., 1919, p. 256, pl. xxv., fig. 40.

Diphobia longicornis Lea.

Plate xix., fig. 4.

Castaneous. Upper surface with sparse and short semi-erect setae. Lea says of this species:—"Readily distinguished from all the other species of the genus by the long terminal joint of the antennae."

The sterna and abdomen are glabrous. The femora are grooved throughout their length, on the under surface, for the reception of the tibiae.

Hab.—Western Australia, Swan River, from nests of twig-mound ant, *Iridomyrmex* sp. Type collected by J. S. Clark.

Length 1.75—2.25 mm.

Genus *Enasiba* Olliff.

E. tristis Olliff. *Proc. Linn. Soc. N.S.W.*, x., 1886, p. 839; Lea, *Proc. Roy. Soc. S. Aust.*, xliii., 1919, p. 254, Pl. xxv., figs 37, 38.

Enasiba tristis Olliff.

Plate xix., fig. 2.

Colour almost black; on the sub-basal impression of the prothorax there are four small short golden fasciae.

Hab.—Western Australia, Swan River. Recently taken by Mr. J. S. Clark in the nests of the twig-mound ant, *Iridomyrmex conifera*.

Length 3.5—4 mm.

Genus *Ectrephes* Pascoe.

E. formicarum Pascoe, *Proc. Ent. Soc. Lond.*, 1866, p. 16; Westw., *Trans. Ent. Soc. Lond.*, 1869, p. 315; Lea, *Proc. Roy. Soc. S. Aust.*, xliii., 1919, p. 256, Pl. xxv., figs. 41, 42.

Kreusleri King. (*Anapestus*), *Trans. Ent. Soc. N.S.W.*, I., 1866, p. 317, t. 16, f. 1.

Ectrepes formicarum Pascoe.

Plate xix., fig. 1.

Colour, yellowish. Lea remarks of this species that "The clothing seems to be particularly liable to abrasion as most of the specimens before me are almost or quite glabrous on the upper surface; on one specimen there were numerous fairly long hairs on the prothorax and elytra, but on floating it off for examination most of the hairs were lost."

Of this species I have two carded specimens before me, received from Mr. Clark. One specimen is quite glabrous, but on the other specimen there are numerous hairs, scattered about the prothorax, arising from the punctures, and along each alternate row of small punctures on the elytra I am able to trace a row of hairs. It would seem probable both from Mr. Lea's observations, and my own, that on an entirely undamaged specimen the hairs would extend over the entire pitted surface of the prothorax, but, not having seen other specimens, I have only figured the scattered hairs.

Hab.—Western Australia, Swan River. Taken in abundance by Mr. J. S. Clark in the nests of *Iridomyrmex conifera*, and one specimen from the nest of *Ectatomma metallicum*.

Length variable, 1.25—2.25 mm.

Genus *Polyplocotes* Westwood.

P. carinaticeps Lea. *Trans. Roy. Soc. S. Aust.*, xliii., 1919, p. 254, Pl. xxv., fig. 39.

Polyplocotes carinaticeps Lea.

Plate xix., fig. 3.

Castaneous. Elytra, abdomen and tip of antennae somewhat paler than other parts. Glabrous.

In the description of this species, Lea says, "Elytra subovate, base truncate, and very little wider than prothorax, with regular rows of distinct and rather small punctures." "Legs rather long and thin."

The specimen figured (Fig. 3) is one of two on a card, and has numerous small hairs on the dorsal surface of the prothorax, some extending down towards the excavation. Some few hairs are also noticeable on the elytra near the base.

The antennae at first appear to be but eight jointed, but the two apical ones are so close together that it is difficult to see the dividing line.

Hab.—Western Australia, Swan River. Taken by Mr. J. S. Clark in the nests of *Cremastogaster conifera*.

Length 1.5 mm.

In describing the type, Lea also remarks that—"This species might have been regarded as belonging to a new genus, but if true inquilines were to be treated as ordinary Coleoptera, it would be necessary to propose almost as many genera as there are species."

FAMILY COLYDIDAE.

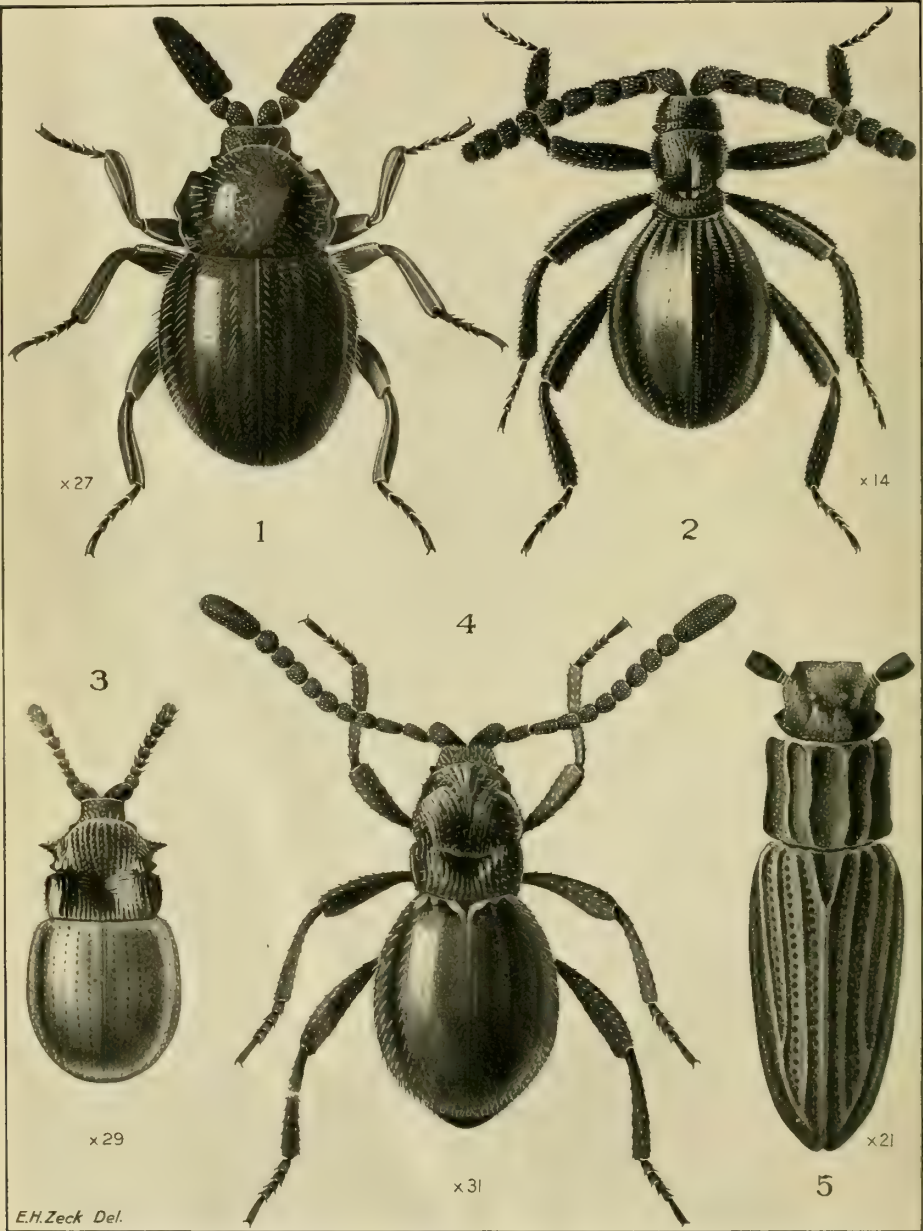
Genus *Euclarkia* Lea.

E. costata Lea, *Trans. Roy. Soc. S. Aust.*, xliii., 1919, p. 180, Pl. xxv., fig. 16.

Euclarkia costata Lea.

Plate xix., fig. 5.

These beetles vary in colour from a dingy black to a brown. In his description of the genus, Lea says—"This remarkable genus is clearly allied to *Kershawia*, and in general appearance the species described below quite strongly resembles *K. rugiceps* on a small scale; with antennae removed there is no strong



Myrmecophilous Coleoptera.

distinguishing feature." "Legs short and fairly stout. Only four distinct tarsal joints are visible. Wings are present." Lea also says, "The antennae at first glance appear to be but one jointed, but a very small basal joint (invisible from above) may be seen, and a second one applied like a thin disk to the base of the third, the latter has its apex slightly concave, and filled with sensitised pubescence."

In the specimen of *E. costata* which I have before me, however, all three joints of the antennae are clearly visible from above and are shown thus in fig. 5.

Lea concludes his description with the following—"A very slow-moving species, of which Mr. Clark obtained numerous specimens by sieving. It is one of the most interesting of the many curious species recently taken by him from nests of the twig-mound ant."

Hab.—Western Australia, Swan River. Taken in numbers by Mr. J. S. Clark, from the nests of *Iridomyrmex*.

Length 3—3.75 mm.

In Plate xix. I have unfortunately been unable to show the legs of *Polyplocotes carinaticeps* and *Euclarkia costata*, as I have feared damaging them by removing them from their cards.

EXPLANATION OF PLATE XIX.

- Fig. 1. *Ectrephes formicarum* Pascoe.
.. 2. *Enasiba tristis* Olliff.
,, 3. *Polyplocotes carinaticeps* Lea.
,, 4. *Diphobia longicornis* Lea.
.. 5. *Euclarkia costata* Lea.

ON A NEW SPECIES OF *LOPHOPODELLA* (POLYZOA).

BY REX W. BRETNALL,

Invertebrate Zoologist, The Australian Museum.

(With a Figure in the text.)

I. INTRODUCTION.

The species about to be described was obtained by Mr. A. R. McCulloch, of the Australian Museum, in February 1920, from the Nepean River, New South Wales. The specimens are from the same locality as, and are specifically identical with, those obtained by him for Dr. Goddard in 1909. These latter were placed in an aquarium, where they died, and were in a state of decomposition when seen by Dr. Goddard, only the statoblasts being entire. Of these he says,¹ "Species of *Plumatella* occur in New South Wales, which, judging from the nature of the statoblasts, differ from any known species"; and in the next paragraph, "Mr. A. McCulloch found in the Nepean River, a mass of Polyzoa growing on a submerged stick; and judging from the nature of the statoblasts. we have in this a new form."

More recent work on the Phylactolaematous Polyzoa, notably that of Annandale,² has now brought this group into more stable form; his key and diagnosis of the genus *Lophopodella* is here amended, his nomenclature being retained. In the preparation of this paper my thanks are due to Mr. A. R. McCulloch, of the Australian Museum, for the preparation of the figures; to Messrs. Kinghorn and Musgrave of the same institution for the collecting of additional material; and to Mr. E. A. Briggs of the University of Sydney for his kindly advice and assistance.

2. METHODS OF PREPARATION.

As I had a large amount of material at my disposal, several methods of preservation were tried; but some of these, although successful with *Fredericella*, failed when applied to *Lophopodella*. The two most successful methods are here detailed, the former giving quite the best results:—

1. The living material was placed in a petri dish, and crystals of Chloral Hydrate were gradually added to the water; when complete anaesthetisation was apparent, and there was no response from the tentacles on being irritated, the specimens were transferred to a fixative recommended by Bles.³ This fixative is:—

70% Alcohol	90 cc.
Glacial Acetic	3 cc.
Formalin	7 cc.

1. Goddard, *Proc. Linn. Soc. N.S.Wales*, XXIV., 1909, p.488.

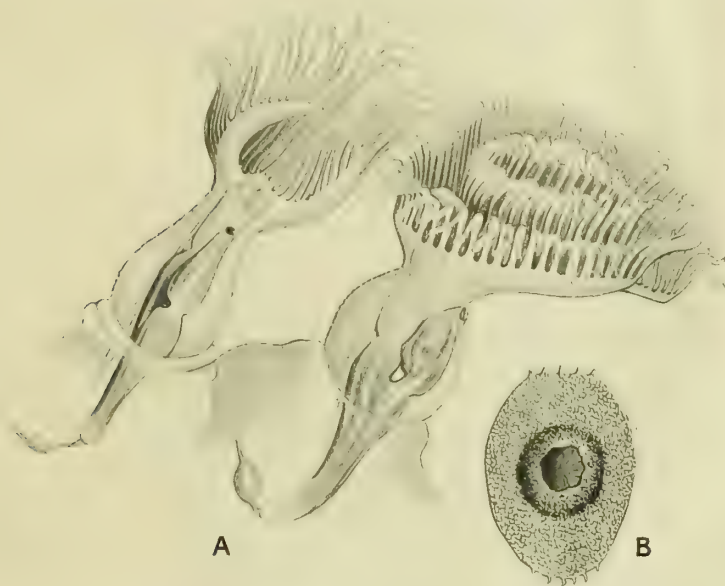
2. Annandale, *Fauna of British India, Freshwater Sponges, Hydroids and Polyzoa*, 1911.

3. Bles, *Trans. Roy. Soc. Edin.*, XLI., 1905, p.792.

Subsequently they were transferred to 70% Alcohol, stained with Erlich's Haematoxylin, and mounted in canada balsam in excavated cells.

2. The specimens were anaesthetised as above and were transferred to a fixative of 10 % solution of Copper Sulphate⁴; then to 70 % alcohol, stained with Erlich's Haematoxylin, and mounted in Canada balsam in excavated cells.

In the second method it was found that over fixation in Copper Sulphate caused the specimens to become more or less opaque, and it was hard to determine a period for effective fixation by this method. Material fixed by these methods will preserve well in 70 % Alcohol or 5 % Formalin.



Lophopodella picta Bretnall. A, two polyps; B, a statoblast.

3. THE GENUS *Lophopodella*.

The diagnosis of the genus *Lophopodella* as given by Annandale both in the key on p. 212 and in the diagnosis on p. 231, may lead to some confusion. In the former it is stated that the "zoaria remain single throughout life"; and in the latter "Polyparia do not form compound colonies." Both these statements would seem to suffer contradiction on reference to the text-figures (especially that on p. 172) and the plate; a contradiction that is not lessened by a further explanation on p. 234 that "Although the zoaria do not form compound colonies by secreting a common membrane or investment, they are markedly gregarious" Rousselet⁵ founded the genus on the statoblast of his genotype (*Lophopus thomasi*); but he

4. As recommended by Harmer, *Cambridge Natural History, Worms Rotifers and Polyzoa*, 1896, p.522.

5. Rousselet, *Journ. Quekett Mic. Club* (2) IX., 1914-6, p.51.

refers to the description of the living colony supplied by the collector after whom the species was named. "The zoarium (or coenoeecium of Allman) that is the whole colony stock, consists of an oval patch of stiff, gelatinous hyaline substance (1. 1, 2) about two inches and a half inches long, by one and a quarter inches broad, and about an eighth of an inch thick, with branching tubular channels radiating from the centre, which were tenanted by numerous polypides. The polypides protruded all around the edge, and on the surface of the gelatinous ectocyst, leaving however a central oval space quite free of them."

From this data, and from the material at my disposal, I conclude that what Annandale has intended to convey is, that the polypides do not communicate one with the other; and further that their origin is not from the gelatinous base, therefore a compound colony is not formed. This, indeed, is the case, but since the polyparia do form a colony, his key and diagnosis are amended accordingly.

4. DIAGNOSIS.

Zoarium consists of a circular or oval mass of no great size.

Polyparia forming colonies of 5 to 25 united to, but not intercommunicating *via*, a gelatinous base, on which the colony is capable of movement.

Polypides lying semi-recumbent in the mass, and seldom standing upright in a vertical position.

Statoblasts of considerable size, compared to the size of the polyparium, and normally bearing at either pole a series of from 5 to 9 chitinous processes, armed with a series of small incurved hooks.

5. KEY.

Order: Phylactolaemata.

Division: Plumatellina.

Family: Plumatellidae.

Sub-family: Lophopinae.

Statoblasts armed normally with hooked processes.

- A. Processes confined to the extremity of the statoblasts; zoaria a circular or oval mass of no great size; polyparia forming colonies of from 5 to 25 united to, but not intercommunicating *via*, a gelatinous base

Lophopodella

- B. Processes entirely surrounding the statoblasts; many zoaria embedded in a common gelatinous base to form large compound colonies

Pectinatella

6. *Lophopodella picta*⁶ sp. nov.

Zoarium. A mass of from 5 to 25 polyparia, appearing to the naked eye like a mass of frog's spawn, united to a hyaline, gelatinous mass, on which the whole is capable of movement.

Zoecium. Hyaline and regularly papillose.

Polypide. From 50 to 60 tentacles are borne on a bright yellow lophophore; the muscles show as a brighter yellow; the stomach is green in colour, and the rectum, charged with excrement, blue. The extended part of the polypide averages .60 mm. in length, and the tentacles .35 in length.

Statoblast. The statoblast is elongate oval in shape, measuring on an average .50 mm. in length by .35 mm. in breadth. The capsule is large compared to the swim-ring, it averaging .10 mm. in diameter, and the swim-ring .07 mm. Either pole bears a series of from 4 to 9 chitinous processes of irregular size, the

6. Having reference to the bright colouring of the polypide.

central being the longest, and averaging .3 mm. in length. These processes are armed with a series of small incurved hooks irregularly disposed, and originating from any side of the process; they are not disposed in parallel planes. A short area at the base of the process is without hooks.

Holotype in the Australian Museum (U. 708).

Locality. Nepean River, N.S. Wales, opposite to Glenbrook Creek.

7. HABITAT.

The specimens were all found on the leaves of a weed (*Vallisneria spiralis*). The Nepean River is subject to considerable alteration, it being in a state of flood in the rainy season, and low and turbid in the dry season. The locality, at the time of the year that these specimens were taken, is one receiving the full strength of the sun for several hours of the day.

8. OBSERVATIONS.

The species is extraordinarily hardy, the first batch, which had been carried without water from Penrith to the Museum, quickly reviving on being placed in an aquarium after this journey of over sixteen hours. They are not nervous, the tentacles being retracted only when actually touched with a needle point; and they are quickly everted again when the needle is withdrawn.

NOTES ON THE BREEDING OF THE SCRUB TURKEY.

BY A. S. LE SOUEF.

During the present season, 1919-20, seven Scrub Turkeys (*Catharturus lathami*) were hatched in the aviaries at Taronga Park. Several birds were in the enclosure, but in July one male took command, and drove the others away, and started to rake over the ground for debris; several cartloads of leaves and garden rubbish were supplied which he industriously collected into a large heap in one corner of the enclosure, and by September a good heat had developed. In this month, too, the wattles of the male developed and became very bright in colour. The hen bird was not allowed to take any part in the preparation of the mound; in fact, she was seldom allowed in the aviary at all. Being unopinioned, she could escape, and spent most of her time in an adjoining shrubbery. The actual egg-laying was not detected. Seven young birds were hatched from the mound, and came out on the following dates:—December 2nd, 6th, 15th, 17th, 31st, January 6th, 9th.

The first bird hatched flew out of the enclosure, over a fence 8 feet high, when only out of the mound a few hours. It weighed four ounces when one day old.

When hatched, the birds were covered with downy feathers, but the primary wing feathers were well developed. They grew very rapidly, and were quickly covered with adult plumage. In two months' time they are practically indistinguishable from the parent birds, except that they are about half the size. The grey mottling on the breast may perhaps be a little brighter on the chick.

During the whole of the incubation period the male bird was constant in his attentions to the mound, opening it up in wet weather and heaping it up again afterwards, but from the day that the last chick was hatched he ceased to take any further interest in it. For a month previous to this his neck wattle had been getting less in size, and by the middle of January he was scarcely distinguishable from the female.

THE WEDGE-TAILED EAGLE.

BY WALTER W. FROGGATT, F.L.S.

Government Entomologist.

Very few Australians, even those who know something about our remarkable bird fauna, are aware that the Wedge-tailed Eagle (*Uroaetus audax*) is the largest eagle in the world. King of the Air, in size and daring, it is not an uncommon thing to shoot one over seven feet six inches from tip to tip of the outspread wings, and there are several more or less reliable records of measurements up to eight feet six. The only larger bird of prey is the great Condor of the South American Andes, which often measures nine feet across the wings. This bird is simply a carrion eater; and though it sometimes attacks young lambs and kids on the mountain side, its feet are too small to carry off an animal of any size. The popular name "Eagle-hawk" dies hard; and it will be a long time before we can persuade the newspaper-writer and bush-naturalist to substitute "Wedge-tailed Eagle" for the absurd and misleading "Eagle-hawk."

The group properly known as "Eagle-Hawks," with short wings and slender legs, is confined to South America, Mexico, and the East Indies and does not extend into Australasia.

The only rival to our great eagle is the Golden Eagle, *Aquila chrysaetus* once common in the forests and mountains of Great Britain, with an extended range over the whole of Europe, Northern Asia to the Himalayas, and Northern Africa. The Canadian Eagle, at one time looked upon as a distinct species, is now considered to be only a varietal form, so that the range is extended over the greater part of North America from Alaska to California.

This was the eagle that was known in the mythology of Greece and Rome as the messenger of Jove. Caius Marius, in his second Consulship, decreed that the legions of Rome only should have the eagle for their emblem. Napoleon adopted it, and the Imperial Eagles of France overran Europe and the East. It was probably a Golden Eagle, according to Pliny, which caused the death of the poet Aeschylus by dropping a tortoise on his head, when he went out on the open plains to escape from the fate of "death falling from the sky" foretold by the Soothsayers.

A great deal of romance has been written about the Golden Eagle, and its daring, and powers of carrying off its prey have been very much exaggerated. Though circumstantial accounts have been given of the Golden Eagle carrying off children five, and even eight, years old, both in Europe and America, modern naturalists state that a three-weeks' old lamb is about as heavy a load as the Golden Eagle can lift off the ground. Its natural food is carrion, and small game, such as rabbits and birds, when carrion is not obtainable.

The citizens of the United States never had such bad taste as to cail "the Greatest Bird on Earth," the American Eagle, a Hawk; yet it is not even a true hunting eagle. Their National Emblem is the White-headed Sea Eagle, also known as the "Bald Eagle," *Haliaeetus leucocephalus*. It has the whole of the

head and neck pure white, and ranges over the whole of North America south to Mexico, and robs other birds of their prey. Benjamin Franklin says, "I wish the Bald Eagle had not been chosen as the representative of our country. He is a bird of bad moral character; he does not get his living honestly. You may have seen him, perched upon some dead tree, where, too lazy to fish for himself, he watches the labours of the fishing hawk; and when that diligent bird has at length taken a fish and is bearing it to his nest for the support of his mate and young ones, the Bald Eagle pursues and takes it from him. Besides, he is a rank coward; the little King bird, no bigger than a sparrow, attacks him boldly, and drives him out of the district. He is therefore by no means a proper emblem for the brave and honest Cincinnati of America."

In Australia we have a smaller fishing eagle, *Haliaeetus leucogaster*, closely allied to the American Eagle, but he is an honest and diligent bird that attends to business and does his own fishing.

The Wedge-tailed Eagle has a wide range over Tasmania and the whole of Australia, as common in the coastal forests, as on the great waste lands of the interior, until the advance of civilization destroyed its natural food, and it had to turn its attention to the squatters' lambs, and was poisoned and shot in retaliation.

The Wedge-tailed Eagle is a keen hunter under natural conditions, and is no more a carrion eater than other eagles, and even then likes its meat fresh. The writer well remembers his first encounter with an eagle in North-western Victoria; he had just killed and skinned a sheep that had broken its leg on the creek bank, and was moving away when he heard a commotion among the waiting crows, and looked round in time to see a great eagle flop down to the ground and waddle up to the carcase.

As far back as 1864 Gould wrote that this Eagle was said to kill lambs in Tasmania, and a bitter war was waged against it by the sheep-owners. He also records about the same date that on the Liverpool Plains he saw from thirty to forty at work stripping the flesh off a dead bullock. In the "Wanderings of a Bush Naturalist," the author calls him the "King of Birds" in Australia, and says that they were so plentiful in Southern Victoria, where he was engaged kangaroo shooting, that he killed over a dozen in the winter.

The number of eagles in the unoccupied land where native game is plentiful, and sheep have only just been introduced, can be estimated from the fact that when the overseer on an inland station in North-west Kimberley poisoned a freshly-skinned sheep, the writer, on visiting the spot a week later, counted forty dead eagles in the vicinity of the carcase.

Before the advent of man our eagles had few enemies, and played a very important part in keeping down the undue increase of the marsupials, big and little, that in spite of the natives swarmed in the scrubs. In those days, woe betide any incautious wallaby, or even large kangaroo, that ventured out of cover in the daytime when a hungry eagle was looking for a dinner for himself and family. Ernest Giles, in his "Australia Twice Traversed," gives a graphic account of such an encounter: "The greatest enemy besides the black man and the dingo, is the large eaglehawk, which, though flying at an enormous height, is always on the watch, but it is only when the wallaby lets itself out on the open stony ridges that the enemy can swoop down upon it. The eagle trusses it with his talons, smashes its head to quiet it, and finally, if a female, it flies away with the victim for food for its young."

Our eagle is certainly a predatory bird, but he hunts for food to live, and only kills when he is hungry, or wants food for his clamouring nestlings. Like

the crow, the eagle is looked upon with no friendly eye by the sheep-owner, and in many districts he is outlawed by the Pastures Protection Boards, and a bounty is given for his head. The bushman does not as a general rule destroy animal life for sport, or wantonly, but the moment he finds that anything is eating his grass or injuring his stock, he is up in arms, and without much inquiry it is doomed.

Granted that the Wedge-tailed Eagles do a good deal of damage among the lambs on the coastal districts at certain times in the year, it may also be noted that this is caused by a number coming coastwards, evidently driven in from the interior through the failure of their natural food supplies, and these should, of course, be brought to task when they start on the lambs. This is, however, no reason why all the solitary pairs, scattered through our forest lands, poising regular districts, all the year round, should be molested. The birds have regular beats, as can be seen from the size of their nests, placed in the fork of some giant gum tree, often containing a drayload of sticks, added to every breeding season. The writer examined the contents of such a nest in the Uralla district, which contained a pair of half-grown nestlings, and the remains of the food supplies were as follows:—Parts of three hares, one opossum, two rabbits, and skins of two fox cubs about a foot long. There was no evidence of a lamb dinner, yet there were many ewes and lambs running in adjacent paddocks.

The writer contends that though certain eagles acquire the habit of killing lambs, just as in Indian villages certain tigers acquire the habit of man-eating, or crows learn to steal eggs, it is not the local ones that harry the flocks. A careful study of the habits of our eagles would soon show that the resident individuals are active and efficient destroyers of ground game, and not enemies of the flocks. The writer would urge that this magnificent bird should not be ruthlessly exterminated, but should be given a fair share of protection by every good Australian, where it is doing no serious harm, but strictly attending to business. The Wedge-tailed Eagle is without question one of the largest and most majestic kings of the air; a bold, brave predatory hunter, and a fair fighter when living under natural conditions, and is quite worthy to be the national emblem of Australia.

A few well-meaning, but misguided, naturalists have recommended the introduction into Australia of carrion buzzards, eagles, and vultures from India, Africa, or America, to eat up the carrion and thus get rid of the sheep maggot flies. At the same time many of our Pastures Protection Boards are offering a bonus for the heads of crows and eagles; birds quite as efficient as scavengers, and not half as dangerous to stock as the proposed imported birds. Let us bring common-sense methods into our work in connection with the preservation of native birds, and not be led away by extremists on either side. The man who says that an eagle should not be destroyed when it acquires the habit of killing lambs is doing harm to the protection of birds just as much as the short-sighted landowner who would shoot or poison every eagle, just because it is an eagle. While the man who advocates the introduction of a carnivorous carrion bird from a foreign land is, if he is successful, adding another doubtful friend, which may become a serious pest in the land of its adoption.

NATURE NOTES.

ALBINO TREE-CREEPER.—In October last year an interesting albino was brought to me for identification. It was shot close to Forbes. The plumage was of the purest white, the eyes being black, and the bill, legs, and feet a pale brownish-grey. I despatched it to the Australian Museum, where it was determined as the Red-browed Tree-creeper, *Climacteris erythrops*.—A. C. BROWNHILL, Forbes.

NEST ON A GAS-BRACKET.—MR. S. W. MOORE sends an interesting account, together with a photograph, which is unfortunately not suitable for reproduction, of the nest of a Black-and-white Fantail, *Rhipidura tricolor*, which was built on a gas bracket on the balcony of the Central Australian Hotel, at Bourke. Despite the fact that the balcony is much used by hotel residents, and that the nest became so loose that the proprietor tied it on with string, a brood of three was successfully reared.

PALLID CUCKOO FEEDING YOUNG.—MR. S. C. BURNELL sends a note from Turrumurra that a Pallid Cuckoo, *Cuculus pallidus*, was observed on the 25th October last, feeding a young one of its own species. The adult bird repeatedly visited a virginia creeper growing over a porch, obtained a grub of the common Vine Moth, and flew back with it to a telegraph wire, upon which the young one was perched, where it passed the grub to the waiting young one. (My own observations have long since convinced me that the Pallid Cuckoo collects its young, sometimes before they are fully able to fend for themselves, and takes them north with it.—Ed.)

PELICANS V. DUCKS.—While touring through the Lower Lachlan River district recently, my attention was called to the fact that pelicans devour young wild ducks.

A brood of about 14 young black ducks, with their mother, was stranded in a small waterhole in the Lachlan River, miles from any other water, the river being at this part practically dry. Five or six pelicans were swimming about on the pond (little more than a puddle), collecting the fish it contained.

One of the pelicans deliberately seized a duckling and swallowed it—my informant (whose veracity is beyond doubt) was astounded, and watched the proceedings. All the pelicans then joined in the chase, and the ducklings quickly disappeared, while their parent fluttered up the bank.

The largest pelican succumbed to a rifle bullet, his well-merited punishment for killing ducks in close season, and his gullet was found to contain five black-ducklings.

I have had no *personal* experience of the destruction of ducks by pelicans, but have on two occasions seen a pelican, when disturbed, disgorge a water rat, while in November 1919, at Benerembah, on the Murrumbidgee, I took from the gullet of a pelican a golden perch which measured 21 inches in length.—H. K. ANDERSON, Manly

WILD DUCKS IN RIVERINA.—Throughout Riverina in normal seasons, wild ducks of various species may be seen with their brood of ducklings in almost every lagoon, waterhole, swamp, &c.

In the course of my journeyings by land and water along the Murrumbidgee River during October and November in good years, I have travelled for miles, and noticed, within vision the whole time, families consisting of the parents and their brood varying from 2 to 18, black, wood, teal, zebra, and other varieties of wild ducks. On one occasion (1918) near Bringagee, a pair of black ducks made their nest within 50 yards of my permanent camp (5 tents), brought out 15 ducklings, and lived, during the remainder of my stay—about three weeks—feeding in the flood waters round the camp, and even landing at the water's edge within 20 feet of my tent.

This season, 1919-20, there are very few young ducks to be seen in Riverina—I have travelled over 2000 miles of this part of N.S.W. during October, November, 1919, and January and February, 1920, and only saw one brood of ducklings, 5 in number, on Colligen Creek near Deniliquin.—H. K. ANDERSON, Manly.

* * * *

FEARLESS HONEYEATER.—One Sunday in June, while walking through some bush between Gordon and Middle Harbour, I noticed a White-eared Honeyeater (*Ptilotis leucotis*) almost at my feet. Thinking that I had flushed the bird from a nest, I looked about for this structure, but could see no sign of it. On again turning my attention to the bird, I realised, from the way it was eyeing my trousers, that it had designs on me. When I stood still, it flew at my knees, and picked at the surface of the tweed. The latter was rather closely woven, and the bird did not succeed in extracting any fibres, and darted back to the bush from which it had come, a couple of feet away. I gently pulled up a trouser leg, and exposed a very shaggy woollen sock, upon which it immediately focussed its attention. With scarcely any hesitation it flew on to the top of my boot, and pecked away for several minutes, until it had gathered a good mouthful of wool, when it flew off to where it was lining its nest, some two hundred yards away. I seated myself on a log some ten feet off, to await its return. In a few minutes it returned to the same bush from which it had commenced operations, and seemed puzzled not to find me there. It soon saw me, however, and flew across, but was apparently not quite reassured, and returned to the original bush once more. It soon returned, and flew to the sleeve of my rough sports coat, working its way thence to my shoulder, upon which it stood for some time, busily fugging out fibres one at a time.

These birds have in the past sadly worried my small dog during the nesting season, but they have not previously attempted to pluck me.—L. HARRISON, Gordon.





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